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Supporting Data FY 1998/1999 Budget Estimate  
Submitted to Congress - February 1997

**DESCRIPTIVE SUMMARIES OF THE**



**RESEARCH, DEVELOPMENT, TEST AND EVALUATION  
Army Appropriation, Budget Activities 1, 2, and 3**

Department of the Army  
Office of the Secretary of the Army (Financial Management and Comptroller)

**"READINESS THROUGH MODERNIZATION"**

**VOLUME I**

**19970314 035**

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**DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS  
OF THE  
RESEARCH, DEVELOPMENT, TEST AND  
EVALUATION, ARMY  
FY 1998/1999  
FEBRUARY 1997**

**VOLUME I  
Budget Activities 1, 2 and 3**

**Department of the Army  
Office of the Assistant Secretary of the Army (Financial Management and Comptroller)**

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ii

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FY 1998/1999 RDT&E, ARMY  
PROGRAM ELEMENT DESCRIPTIVE SUMMARIES

INTRODUCTION AND EXPLANATION OF CONTENTS

1. **General.** This section has been prepared for the purpose of providing information concerning the Army Research, Development, Test and Evaluation program. The Descriptive Summaries are comprised of R-2 (Budget Item Justification Sheet) and R-3 (RDT&E Program Element/Project Cost Breakdown) Exhibits which provide narrative information on all RDT&E program elements and projects for the FY 1996, 1997, 1998 and 1999 time period.

2. **Relationship of the FY 1998/1999 Budget Submission to the FY 1997 Budget submitted to Congress.** This paragraph provides a list of program elements restructured, transitioned, or established to provide specific program identification.

A. **Program Element Restructures.** Explanations for these changes can be found in the narrative sections of the Program Element R-2/R-3 Exhibits.

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0601102A/S16	Science Base/Combat Casualty Care Research	0601102A/S14
0602618A/H81, 0603004A/43A	Liquid Propellant Technology Program	0602618A/H37
0602624A/H28	Fuze Technology	0602624A/H36
0602712A/H24	Camouflage Technology	0602712A/H35
0602785A/791	Personnel System/Performance Technology	0602785A/790
0602787A/825	Combat Casualty Care Technology	0602787A/874
0603001A/XXA	Force XXI Land Warrior	0603001A/J50
0603003A/D368	Improved Cargo Helicopter	0203744A/D430
0603004A/L95	Landmine Warfare Dev	0603004A/43A
0603007A/793	Training Sys and Education	0603007A/792
0603313A/D380	Guided MLRS	0603778A/D784
0604760A/DC77	Computer Generated Forces	0604760A/DC78
0605601A/DE90, DE91, DE92, DE93, D618, D632 & D630	Army Test Ranges and Facilities	0605601A/DF30

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A. Program Element Restructures (continued).

OLD PE/PROJECT	NEW PROJECT TITLE	NEW PE/PROJECT
0605601A/D630	Non-Major System Test & Design Evaluation	0605601A/D699
0605641A/D670, D671, D672, D672, D675 & D678	Survivability Evaluation	0605604A/D734
0605706A/D026	Major Systems Test, Design and Evaluation	0605706A/M542
0303142A/D384 & /D386	Automated Communications Management System	0303142A/D559

B. FY 1998 Developmental Transitions.

FROM PE/PROJECT	PROJECT TITLE	TO PE/PROJECT
0602120A/AH15	Dismounted Soldier Combat Identification (CID)	0604817A/D902
0602303A/214	2.75" Anti-Air Tech Demo	0603313A/549
0603313A/387	Multi-Purpose Individual Munition	0604802A/284

C. Establishment of New FY 1998 Program Elements/Projects. There are no major system new starts. Minor new initiatives for FY 1998, in addition to Congressionally directed initiatives for FY 1997, are shown below with asterisks. The remaining programs listed are outyear initiatives or restructures beyond FY 1998 or were previously funded from other Defense appropriations.

TITLE	PE/PROJECT
Voice Instructional Device*	0602601A/AH39
Plasma Energy Pyrolysis System*	0602720A/A876
Western Environmental Technology Office (WETO)	0602720A/A877
Environmental Support*	
Neurotoxin Exposure Treatment*	0602787A/A838
Cancer Signal/Cancer Cell Proliferation*	0602787A/A839
Computer-Assisted Minimally Invasive Surgery*	0602787A/A841
ENT Minimally Invasive Simulation*	0602787A/A842

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C. Establishment of New FY 1998 Program Elements/Projects (continued).

TITLE	PE/PROJECT
Health Technology Roadmaps*	0602787A/A843
Hepatitis A Vaccine*	0602787A/A844
Trichloromelamine*	0603002A/D813
Neurofibromatosis*	0603002A/D814
National Medical Testbed*	0603002A/D815
Computer-Based Decision Support Systems*	0603002A/D816
Computer-Aided Diagnostic Research*	0603002A/D817
Advanced Cancer Detection Center*	0603002A/D818
Nautilus/THEL*	0603308A/D989
Battle Integration Center*	0603308A/D997
LCPK for 2.75 Inch Rockets	0603313A/A567
Advanced Light Anti-Armor Weapon System (ALAWS)*	0603607A/D664
Future Combat System	0603645A/DQ19
LTASS	0603774AD598
Future Scout Vehicle - Advanced Development*	0603645A/D018
Suite of Integrated Infrared Countermeasures Op Test*	0604270A/D2VT
Arm Treatment & Transport Vehicle	0604640A/DG28
Future Scout Vehicle - EMD	0604645A/D022
Mounted Warrior*	0604713A/D680
XM982*	0604802A/D695
Army Systems Engineering & Warfighting Technical Spt*	0604805A/D589
Modernization of Utilities*	0605678A/M744
Survivability Evaluation	0605604A/D734
Ground Combat Vehicle HTI*	0203735A/D718
Bradley A3 P3I (BFV A4)	0203735A/D377
Guardrail Common Sensor	0203744A/D028
UH-60 Door Gun*	0203744A/D504
Force XXI Initiatives*	0203758A/D376
Longbow Hellfire PIP	0203802A/D785
Joint Precision Approach Landing System (JPALS)	0305114A/D711
MLRS Army Technical Architecture*	0603778A/D093
Weapons Systems Modernization Software Maintenance	0708045A/DE26

v

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D. FY 1998 programs for which funding was shown in the FY 1997 President's Budget Submit (February 1996), but which are no longer funded.

PE/PROJECT	TITLE	BRIEF EXPLANATION
0203735A/D2UT	Abrams IOTE	Funds transferred to system line.
0601101A/91E	ILIR-ARI	Program terminated
0601102A/S16	Science Base/Combat Dentistry Research	Program terminated
0602120A/H25	Nuc Effects Surv Tech	Program terminated
0602624A/H23	Non-Lethal Weapons Technology	Program terminated
0602783A/094	Tactical Software Technology	Program terminated
0603627A/E79	Smoke, Obscurant - Advanced Development	Funds transferred to system line
0602787A/825	Combat Maxillofacial Injury	Program terminated
0603001A/594	Metrology & Calibration	Program terminated
0603001A/J28	Test Measurement Technology Development	Program terminated

Descriptive summaries for PE 0603806A - NBC Defense Systems, AD and PE 0604806A - NBC Defense Systems, ED are not provided in this Army submission. Since these programs were transferred to Defense RDT&E in FY 1996, program details are available in the Defense RDT&E submission under PE 0603884BP and PE 0604384BP.

3. Classification. This document contains no classified data. Classified/Special Access Programs which are submitted offline are listed below.

0203735A/DC64	0603003A/DB38/D391	0603710A/DC63
0203806A	0603005A/DC62	0603851A
0203808A	0603009A	0603854A/DC68
0602601A/AC84/DC83	0603013A	0604649A/DG15
0602104A	0603017A	0604328A/DC71
0602122A	0603018A	
0602712A/AC61	0603020A	
0602786A/AC60	0603322A	

Department of the Army  
FY 1998/1999 RDT&E Program

Exhibit R-1

## Summary

Date: Feb 1997

	Thousands of Dollars		
	FY 1996	FY 1997	FY 1998
Summary Recap of Budget Activities			
Basic Research	181,722	179,059	198,854
Applied Research	450,837	551,558	462,935
Advanced Technology Development	580,033	677,676	418,322
Demonstration and Validation	454,454	558,250	523,395
Engineering and Manufacturing Development	1,124,738	1,141,159	1,107,393
RDT&E Management Support	1,234,657	1,072,165	1,136,576
Operational Systems Development	730,971	750,761	663,368
Total Research Development Test & Eval Army	4,757,412	4,930,628	4,510,843
Summary Recap of FYDP Programs			
Strategic Forces	4,000	26,376	86,193
General Purpose Forces	560,107	541,129	403,355
Intelligence and Communications	64,814	72,633	89,316
Research and Development (FYDP Program 6)	4,094,970	4,242,671	3,874,153
Central Supply and Maintenance	23,699	47,819	44,326
Administration and Assoc Activities	322	0	0
Support of Other Nations	9,500	0	13,500
Total Research Development Test & Eval Army	4,757,412	4,930,628	4,510,843
			4,496,724

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viii

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Department of the Army  
FY 1998/1999 RDT&E Program

Appropriation: 2040 A Research Development Test & Eval Army

Date: Feb 1997

Program		Thousands of Dollars				
Line Element		Act	FY 1996	FY 1997	FY 1998	FY 1999
No	Number Item					
1	0601101A IN-HOUSE LABORATORY INDEPENDENT RESEARCH	1	13,657	14,393	15,113	15,828
2	0601102A DEFENSE RESEARCH SCIENCES	1	121,822	119,739	138,165	141,555
3	0601104A UNIVERSITY AND INDUSTRY RESEARCH CENTERS	1	46,243	44,927	45,576	52,966
	Basic Research		181,722	179,059	198,854	210,349
4	0602104A TRACTOR ROSE	2	2,484	3,065	0	0
5	0602105A MATERIALS TECHNOLOGY	2	9,858	14,530	9,811	10,979
6	0602120A SENSORS AND ELECTRONIC SURVIVABILITY	2	26,675	19,351	19,294	19,682
7	0602122A TRACTOR HIP	2	5,603	7,981	7,242	8,170
8	0602211A AVIATION TECHNOLOGY	2	17,853	21,898	27,282	30,281
9	0602270A EW TECHNOLOGY	2	14,651	15,510	16,528	18,151
10	0602303A MISSILE TECHNOLOGY	2	17,535	29,144	22,335	24,002
11	0602308A MODELING & SIMULATION TECHNOLOGY	2	19,466	20,652	21,059	24,287
12	0602601A COMBAT VEHICLE AND AUTOMOTIVE TECHNOLOGY	2	35,040	34,312	33,112	33,360
13	0602618A BALLISTICS TECHNOLOGY	2	34,647	39,913	33,317	37,598
14	0602622A CHEMICAL, SMOKE AND EQUIP DEFEATING TECHNOLOG	2	1,728	2,259	4,739	6,691
15	0602623A JOINT SERVICE SMALL ARMS PROGRAM	2	4,857	4,497	4,786	5,204
16	0602324A WEAPONS AND MUNITIONS TECHNOLOGY	2	24,297	22,246	26,980	30,613
17	0602705A ELECTRONICS AND ELECTRONIC DEVICES	2	21,134	24,351	20,192	22,374
18	0602709A NIGHT VISION TECHNOLOGY	2	16,442	16,636	17,304	19,213
19	0602712A COUNTERMINE SYSTEMS DEVELOPMENT	2	0	7,372	10,598	10,715
20	0602716A HUMAN FACTORS ENGINEERING TECHNOLOGY	2	15,445	15,968	14,256	15,626
21	0602720A ENVIRONMENTAL QUALITY TECHNOLOGY	2	25,537	55,178	17,519	13,869
22	0602782A COMMAND, CONTROL, COMMUNICATIONS TECHNOLOGY	2	13,130	14,976	16,838	18,180
23	0602783A COMPUTER AND SOFTWARE TECHNOLOGY	2	3,843	6,500	679	337
24	0602784A MILITARY ENGINEERING TECHNOLOGY	2	33,734	38,060	36,422	40,112
25	0602785A MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	2	7,254	9,329	9,014	9,019
26	0602786A LOGISTICS TECHNOLOGY	2	26,995	21,319	17,689	18,565
27	0602787A MEDICAL TECHNOLOGY	2	70,575	104,332	74,684	75,307
28	0602789A ARMY ARTIFICIAL INTELLIGENCE TECHNOLOGY	2	2,054	2,179	1,255	1,330
	Applied Research		450,837	551,558	462,935	493,665



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Department of the Army  
FY 1998/1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test &amp; Eval Army

Date: Feb 1997

Line Element	Program	No	Number	Item	Act	Thousands of Dollars		
						FY 1996	FY 1997	FY 1998
29	0603001A			LOGISTICS ADVANCED TECHNOLOGY	3	38,820	22,724	35,469
30	0603002A			MEDICAL ADVANCED TECHNOLOGY	3	90,591	201,198	10,677
31	0603003A			AVIATION ADVANCED TECHNOLOGY	3	48,320	56,165	31,330
32	0603004A			WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	3	29,119	29,122	18,255
33	0603005A			COMBAT VEHICLE AND AUTOMATIVE ADVANCED TECH	3	26,363	28,811	32,685
34	0603006A			COMMAND, CONTROL, COMM ADVANCED TECHNOLOGY	3	29,323	29,379	19,688
35	0603007A			MANPOWER, PERSONNEL AND TRAINING ADV TECH	3	4,576	4,406	3,003
36	0603009A			TRACTOR HIKE	3	23,016	16,791	14,350
37	0603013A			TRACTOR DIRT	3	1,713	3,265	3,393
38	0603017A			TRACTOR RED	3	5,369	8,445	5,572
39	0603020A			TRACTOR ROSE	3	4,731	4,971	9,204
40	0603105A			MILITARY HIV RESEARCH	3	2,795	17,544	2,713
41	0603238A			Global Surveillance/Air Defense/Precision Strike Technology Demo	3	37,630	22,009	11,664
42	0603270A			EW TECHNOLOGY	3	3,818	6,651	8,182
43	0603313A			MISSILE AND ROCKET ADVANCED TECHNOLOGY	3	109,972	99,819	117,139
44	0603322A			TRACTOR CAGE	3	8,088	8,651	6,412
45	0603606A			LANDMINE WARFARE AND BARRIER ADV TECHNOLOGY	3	25,006	27,629	19,332
46	0603607A			JOINT SERVICE SMALL ARMS PROGRAM	3	4,516	9,049	4,754
47	0603654A			LINE-OF-SIGHT TECHNOLOGY DEMO	3	13,396	9,791	13,000
48	0603710A			NIGHT VISION ADVANCED TECHNOLOGY	3	31,142	29,761	19,299
49	0603734A			MILITARY ENGINEERING ADVANCED TECHNOLOGY	3	14,544	20,213	12,231
50	0603772A			ADV TACTICAL COMPUTER SCIENCE & SENSOR TECH	3	27,185	21,282	19,970
	Advanced Technology Development					580,033	677,676	418,322
51	0603018A			TRACTOR TREAD	4	14,158	2,329	0
52	0603308A			ARMY MISSILE DEFENSE SYSTEMS INTEGRATION	4	23,443	66,462	24,138
53	0603619A			LANDMINE WARFARE AND BARRIER - ADV DEV	4	35,768	27,860	18,882
54	0603627A			SMOKE, OBSCURANT AND TARGET DEFEATING SYS-AD	4	2,623	6,246	0
55	0603639A			ARMAMENT ENHANCEMENT INITIATIVE	4	58,227	63,240	40,313
56	0603640A			ARTILLERY PROPELLANT DEVELOPMENT	4	20,811	8,322	8,521
57	0603645A			ARMORED SYSTEMS MODERNIZATION-ADVANCED DEVE	4	181,647	7,803	2,007

x

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Department of the Army  
FY 1998/1999 RDT&E Program

Appropriation: 2040 A Reserach Development Test &amp; Eval Army

Date: Feb 1997

Line Element	Program	No	Number	Item	Act	Thousands of Dollars			
						FY 1996	FY 1997	FY 1998	FY 1999
58	0603649A			ENGINEER MOB EQUIP ADVANCED DEV	4	13,591	0	0	0
59	0603653A			ADVANCED TANK ARMAMENT SYSTEM	4	9,335	11,395	8,982	8,928
60	0603713A			ARMY DATA DISTRIBUTION SYTEM	4	6,360	23,170	21,214	10,049
61	0603745A			TACTICAL ELECTRONIC SUPPORT SYSTEMS - ADV DEV	4	5,630	3,941	0	0
62	0603747A			SOLDIER SUPPORT AND SURVIVABILITY	4	6,709	6,541	7,557	7,680
63	0603766A			TAC EXPLOIT OF NAT CAP (TENCAP)-DEM/VAL TIARA	4	26,796	25,354	20,920	23,714
64	0603774A			NIGHT VISION SYSTEMS ADVANCED DEVELOPMENT	4	3,167	2,769	2,939	2,893
65	0603790A			NATO RESEARCH AND DEVELOPMENT (H)	4	0	9,755	13,168	11,169
66	0603801A			AVIATION - ADV DEV	4	12,893	13,104	7,132	7,450
67	0603802A			WEAPONS AND MUNITIONS - ADV DEV	4	949	0	0	0
68	0603804A			LOGISTICS AND ENGINEER EQUIPMENT - ADV DEV	4	5,587	7,433	6,783	6,833
69	0603805A			CBT SERVICE SUPPORT CONTROL SYS EVAL & ANALYS	4	13,228	12,689	7,673	7,783
70	0603807A			MEDICAL SYSTEMS - ADV DEV	4	9,878	9,996	6,765	8,700
71	0603851A			TRACTOR CAGE (Dem/Val)	4	3,234	3,001	1,948	1,627
72	0603854A			ARTILLERY SYSTEMS DEMONSTRATION/VALIDATION	4	0	238,590	324,380	294,495
73	0603856A			SCAMP BLOCK II (SPACE)	4	0	8,250	73	9,669
74	0603889A			COUNTERDRUG R&D PROJECTS	4	420	0	0	0
				Demonstration and Validation		454,454	558,250	523,395	445,831
75	0604201A			AIRCRAFT AVIONICS	5	20,073	14,694	21,669	12,729
76	0604220A			ARMED, DEPLOYABLE OH-58D	5	688	1,130	0	0
77	0604223A			COMANCHE	5	284,131	331,424	282,009	371,927
78	0604270A			EW DEVELOPMENT	5	62,250	73,886	66,212	51,490
79	0604321A			ALL SOURCE ANALYSIS SYSTEM	5	49,912	39,308	24,045	26,228
80	0604325A			FOLLOW-ON TO TOW	5	944	5,479	13,949	50,884
81	0604328A			TRACTOR CAGE	5	0	1,524	11	303
82	0604604A			MEDIUM TACTICAL VEHICLES	5	2,923	5,874	3,729	0
83	0604609A			SMOKE, OBSCURANT AND TARGET DEFEATING SYS-ED	5	1,915	0	0	703
84	0604611A			JAVELIN (AWWS-M)	5	2,249	6,014	8,018	5,277
85	0604619A			LANDMINE WARFARE	5	29,453	26,288	19,800	23,075
86	0604622A			FAMILY OF HEAVY TACTICAL VEHICLES	5	2,605	1,958	0	0

xi

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Department of the Army  
FY 1998/1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test &amp; Eval Army

Date: Feb 1997

Line Element	Program No Number	Item	Act	Thousands of Dollars			
				FY 1996	FY 1997	FY 1998	FY 1999
87	0604633A	AIR TRAFFIC CONTROL	5	5,073	7,377	1,705	1,729
88	0604640A	ADVANCED COMMAND AND CONTROL VEHICLE	5	17,306	7,734	8,867	0
89	0604641A	TACTICAL UNMANNED GROUND VEHICLE	5	0	2,823	2,687	2,663
90	0604642A	LIGHT TACTICLE WHEELED VEHICLE	5	3,970	2,937	9,909	39,919
91	0604645A	ARMORED SYSTEMS MODERNIZATION (ASM)-ENG DEV	5	32,425	6,585	0	0
92	0604649A	ENGINEER MOBILITY EQUIPMENT DEVELOPMENT	5	19,114	46,705	56,196	63,069
93	0604710A	NIGHT VISION SYSTEMS - ENG DEV	5	37,658	34,870	33,456	21,255
94	0604713A	COMBAT FEEDING, CLOTHING, AND EQUIPMENT	5	16,049	76,428	55,964	43,539
95	0604715A	NON-SYSTEM TRAINING DEVICES - ENG DEV	5	50,140	48,788	76,749	73,048
96	0604716A	TERRAIN INFORMATION - ENG DEV	5	8,509	7,144	2,942	2,686
97	0604726A	INTEGRATED METEOROLOGICAL SUPPORT SYSTEM	5	0	0	1,946	1,931
98	0604739A	JTT/CIBS-M (TIARA)	5	0	4,765	4,499	4,447
99	0604740A	TACTICAL SURVEILLANCE SYSTEM - ENG DEV	5	2,954	0	0	0
100	0604741A	AIR DEFENSE C2I - ENG DEV	5	21,810	20,031	18,350	6,698
101	0604746A	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	5	10,648	9,575	2,582	2,533
102	0604760A	DISTRIBUTIVE INTERACTIVE SIMULATIONS ENG DEV	5	0	15,631	20,895	9,242
103	0604766A	TAC EXPLOIT NAT CAP (TENCAP)-EMD (TIARA)	5	23,266	15,235	19,113	19,531
104	0604768A	BRILLIANT ANTI-ARMOR SUBMUNITION(BAT)	5	190,472	161,816	202,302	129,466
105	0604770A	JOINT SURVEILLANCE/TARGET ATTACK RADAR SYSTEM	5	15,302	9,624	6,940	5,670
106	0604778A	POSITIONING SYS DEVEL (SPACE)	5	436	428	419	409
107	0604780A	COMBINED ARMS TACTICAL TRAINER (CATT)	5	56,282	26,110	2,823	2,866
108	0604801A	AVIATION - ENG DEV	5	4,885	5,403	5,109	6,067
109	0604802A	WEAPONS AND MUNITIONS - ENG DEV	5	14,845	23,661	3,577	24,865
110	0604804A	LOGISTICS & ENGINEER EQUIPMENT - ENG DEV	5	19,132	19,903	28,039	26,932
111	0604805A	COMMAND, CONTROL, COMMUNICATIONS SYSTEMS - ED	5	16,740	9,556	11,052	16,395
112	0604807A	MEDICAL MATERIEL/MED BIO DEFENSE EQUIPMENT ED	5	4,644	4,693	4,483	5,408
113	0604808A	LANDMINE WARFARE/BARRIER - ENG DEV	5	6,802	7,556	22,605	44,133
114	0604814A	SENSE AND DESTROY ARMOR - ENG DEV	5	15,764	9,934	22,372	20,813
115	0604816A	Longbow	5	21,969	10,644	0	0
116	0604817A	COMBAT IDENTIFICATION	5	23,669	16,411	19,784	13,379
117	0604818A	ARMY TACTICAL COMM & CONT HARDWARE & SOFTWARE	5	27,231	15,780	20,022	18,697
118	0604820A	RADAR DEVELOPMENT	5	500	0	0	0

xii

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Department of the Army  
FY 1998/1999 RDT&E Program

Appropriation: 2040 A Research Development Test &amp; Eval Army

Date: Feb 1997

Line	Program Element	No	Number	Item	Act	Thousands of Dollars			
						FY 1996	FY 1997	FY 1998	FY 1999
119	0604823A			FIREFINDER	5	0	2,496	2,564	12,022
120	0604854A			ARTILLERY SYSTEMS - ENGINEERING DEVELOPMENT	5	0	2,937	0	897
				Engineering and Manufacturing Development		1,124,738	1,141,159	1,107,393	1,162,925
121	0604256A			THREAT SIMULATOR DEVELOPMENT	6	13,705	11,383	14,004	11,877
122	0604258A			TARGET SYSTEMS DEVELOPMENT	6	13,557	9,916	11,688	13,063
123	0604759A			MAJOR TEST & EVALUATION INVESTMENT	6	62,154	40,833	40,449	33,407
124	0605103A			RAND ARROYO CENTER	6	17,895	21,108	17,576	18,040
125	0605301A			ARMY KWAJALEIN ATOLL	6	140,930	143,789	138,769	142,125
126	0605502A			SMALL BUS INV RSCH/SMALL BUS TECH PILOT PROG	6	85,919	0	0	0
127	0605601A			ARMY TEST RANGES AND FACILITIES	6	142,694	130,222	122,117	128,919
128	0605602A			ARMY TECHNOLOGY & SUSTAINING INSTRUMENTATION	6	25,422	21,944	33,184	32,976
129	0605604A			SURVIVABILITY/LETHALITY ANALYSIS	6	32,250	30,675	32,330	30,678
130	0605605A			DOD HIGH ENERGY LASER SYS TEST FAC (HELSTF)	6	33,231	29,974	14,952	14,976
131	0605606A			AIRCRAFT CERTIFICATION	6	2,821	2,840	2,919	2,924
132	0605702A			METEOROLOGICAL SUPPORT TO RDT&E ACTIVITIES	6	6,458	6,348	6,434	6,658
133	0605706A			MATERIEL SYSTEMS ANALYSIS	6	17,241	14,126	29,707	28,675
134	0605709A			EXPLOITATION OF FOREIGN ITEMS	6	8,413	7,193	7,762	4,349
135	0605712A			SUPPORT OF OPERATIONAL TESTING	6	41,078	49,614	81,672	68,949
136	0605801A			PROGRAMWIDE ACTIVITIES	6	64,859	59,708	86,208	85,604
137	0605802A			INTERNATIONAL COOPERATIVE RESEARCH AND DEV	6	1,555	1,534	1,581	1,581
138	0605803A			TECHNICAL INFORMATION ACTIVITIES	6	13,549	16,552	15,451	15,872
139	0605805A			MUNITIONS STANDARDIZATION EFFECTIVENESS & SAFETY	6	16,692	3,211	6,317	5,895
140	0605853A			ENVIRONMENTAL CONSERVATION	6	2,493	1,723	1,778	2,977
141	0605854A			POLLUTION PREVENTION	6	11,004	13,602	5,353	4,681
142	0605856A			ENVIRONMENTAL COMPLIANCE-RDT&E	6	65,985	54,251	51,378	47,604
143	0605876A			MINOR CONSTRUCTION (RPM) - RDTE	6	6,035	4,229	4,393	4,537
144	0605878A			MAINTENANCE AND REPAIR (RPM) - RDTE	6	86,907	68,580	85,119	74,681
145	0605879A			REAL PROPERTY SERVICES (RPS)	6	0	90,457	88,945	88,936
146	0605896A			BASE OPERATIONS-RDT&E	6	306,481	219,946	231,653	233,633

Department of the Army  
FY 1998/1999 RDT&E Program

Exhibit R-1

Appropriation: 2040 A Research Development Test &amp; Eval Army

Date: Feb 1997

Program Line Element	No	Number	Item	Act	Thousands of Dollars		
					FY 1996	FY 1997	FY 1998
147 0605898A MANAGEMENT HEADQUARTERS (RSCH & DEVELOPMENT)	6				15,007	18,407	4,837
148 0909999A CLOSED ACCOUNT ADJUSTMENT	6				322	0	0
RDT&E Management Support					1,234,657	1,072,165	1,136,576
149 0603778A MLRS PRODUCT IMPROVEMENT PROGRAM	7				68,851	62,804	26,678
150 0102419A AEROSTAT JOINT PROGRAM	7				4,000	26,376	86,193
151 0203726A ADV FIELD ARTILLERY TACTICAL DATA SYSTEM	7				36,973	38,512	39,039
152 0203735A COMBAT VEHICLE IMPROVEMENT PROGRAMS	7				206,625	206,816	136,520
153 0203740A MANEUVER CONTROL SYSTEM	7				48,302	27,888	25,641
154 0203744A AIRCRAFT MODIFICATIONS/PRODUCT IMPROV PROGRAM	7				4,288	22,386	2,609
155 0203752A AIRCRAFT ENGINE COMPONENT IMPROVEMENT PROGRA	7				3,703	3,834	2,940
156 0203758A DIGITIZATION	7				110,583	137,078	156,960
157 0203801A MISSILE/AIR DEFENSE PRODUCT IMPRV PROGRAM	7				59,199	64,557	17,412
158 0203802A OTHER MISSILE PRODUCT IMPROVEMENT PROGRAMS	7				64,920	9,874	1,255
159 0203806A TRACTOR RUT	7				3,346	3,112	2,111
160 0203808A TRACTOR CARD	7				9,521	6,766	6,690
161 0208010A JOINT TACTICAL COMMUNICATIONS PROG (TRI-TAC)	7				12,647	18,229	8,983
162 0208053A JOINT TACTICAL GRD STATION (TIARA)	7				0	2,077	3,195
163 0301359A SPECIAL ARMY PROGRAM	7				8,538	10,185	5,547
164 0303140A COMMUNICATIONS SECURITY (COMSEC) EQUIPMENT	7				3,455	3,161	9,647
165 0303142A SATCOM GROUND ENVIRO (SPACE)	7				52,821	39,421	57,827
166 0303150A ARMY GLOBAL C2 SYS	7				0	19,389	15,045
167 0305114A TRAFFIC CNTL/APPROACH/LANDING SYS (JPALS)	7				0	0	750
168 0305128A SECURITY AND INTELLIGENCE ACTIVITIES	7				0	477	500
169 0708045A End Item Industrial Preparedness Activities	7				23,699	47,819	44,326
170 1001018A NATO JSTARS - TIARA	7				9,500	0	13,500
Operational Systems Development					730,971	750,761	663,368
Total Research Development Test & Eval Army					4,757,412	4,930,628	4,510,843
							4,496,724

## FY97 COLUMN OF FY98/99 PRES BUD

The spreadsheet below reflects the FY97 column of the FY98/99 President's Budget by project. It is provided as clarification to the attached descriptive summaries. In the Project Change Summary (paragraph B of Exhibit R-2), we have reflected the FY97 Appropriated Value as the amount Congress appropriated less undistributed reductions in Sections 8136, 8138, and 8037 (column G of spreadsheet). This methodology is consistent with past practices and is consistent throughout this submission. However, we just recently realized that we should have shown the amount appropriated prior to any reductions (column A), and the total of those reductions (column F) as Adjustments to Appropriated Value. Unfortunately, time did not allow us to change over 400 descriptive summaries before the deadline for this submission. We intend to use this methodology for all future submissions.

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
1	61101	91A	9893	-198	-9			-207	9686
1	61101	91C	3910	-78	-4			-82	3828
1	61101	91D	768	-15	-1			-16	752
1	61101	91E	130	-3	0			-3	127
			14701	-294	-14	0	0	-308	14393
1	61102	305	1156	-23	-1			-24	1132
1	61102	31B	2281	-46	-2			-48	2233
1	61102	52C	2243	-45	-2			-47	2196
1	61102	53A	3605	-72	-3			-75	3530
1	61102	74A	2303	-46	-2			-48	2255
1	61102	74F	2462	-49	-2			-51	2411
1	61102	F20	2333	-47	-2			-49	2284
1	61102	F22	447	-9	0			-9	438
1	61102	H42	1775	-35	-2			-37	1738
1	61102	H43	5584	-112	-6			-118	5466
1	61102	H44	3354	-67	-3			-70	3284
1	61102	H45	1848	-37	-2			-39	1809
1	61102	H47	2811	-56	-4			-60	2751
1	61102	H48	6872	-137	-6			-143	6729
1	61102	H52	849	-17	-1			-18	831
1	61102	H57	47844	-957	-45	-22	-8	-1032	46812
1	61102	H66	1314	-26	-1			-27	1287
1	61102	H67	4901	-98	-5			-103	4798
1	61102	H68	350	-7	0			-7	343
1	61102	S04	598	-12	-1			-13	585
1	61102	S13	8430	-169	-8			-177	8253
1	61102	S14	3830	-77	-4			-81	3749
1	61102	S15	5661	-113	-5			-118	5543
1	61102	S16	468	-9	0			-9	459

xv

UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
								(B+C+D+E)	(A-F)
1	61102	S17	800	-16	-1			-17	783
1	61102	T22	1767	-35	-2			-37	1730
1	61102	T23	1532	-31	-1			-32	1500
1	61102	T24	1128	-23	-1			-24	1104
1	61102	T25	3136	-63	-3			-66	3070
1	61102	S18	650	-13	-1			-14	636
			122332	-2447	-116	-22	-8	-2593	119739
1	61104	H50	6853	-137	-6			-143	6710
1	61104	H53	690	-14	-1			-15	675
1	61104	H54	7252	-145	-7			-152	7100
1	61104	H56	4469	-89	-4			-93	4376
1	61104	H59	5797	-116	-5			-121	5676
1	61104	H62	10043	-201	-9			-210	9833
1	61104	H64	2899	-58	-3			-61	2838
1	61104	H65	2899	-58	-3			-61	2838
1	61104	H73	4986	-100	-5	0	0	-105	4881
			45888	-918	-43	0	0	-961	44927
			182921	-3659	-173	-22	-8	-3862	179059
2	62104	B79	3131	-63	-3			-66	3065
			3131	-63	-3	0	0	-66	3065
2	62105	H84	14841	-297	-14	0	0	-311	14530
			14841	-297	-14	0	0	-311	14530
2	62120	I40	2651	-53	-2			-55	2596
2	62120	H15	3686	-74	-3		-5	-82	3604
2	62120	H16	13455	-269	-13	-22		-304	13151
2	62120	H25	0	0	0			0	0
			19792	-396	-18	-22	-5	-441	19351
2	62122	622	8152	-163	-8	0		-171	7981
			8152	-163	-8	0	0	-171	7981

xvi

UNCLASSIFIED

## FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS (A-F)
2	62211	47A	19640	-393	-18		-16	-427	19213
2	62211	47B	2743	-55	-3			-58	2685
			22383	-448	-21	0	-16	-485	21898
2	62270	442	8783	-176	-8			-184	8599
2	62270	906	7062	-141	-7	-3		-151	6911
			15845	-317	-15	-3	0	-335	15510
2	62303	214	25795	-516	-24		-27	-567	25228
2	62303	205	4000	-80	-4			-84	3916
			29795	-596	-28	0	-27	-651	29144
2	62308	C90	9516	-190	-9	-19		-218	9298
2	62308	C99	11618	-232	-11	-21		-264	11354
			21134	-422	-20	-40	0	-482	20652
2	62601	C05	5982	-120	-6		-2	-128	5854
2	62601	H39	2100	-42	-2			-44	2056
2	62601	H77	10544	-211	-10		-5	-226	10318
2	62601	H82	3090	-62	-3			-65	3025
2	62601	H91	13384	-268	-13	-5	-39	-325	13059
			35100	-703	-34	-5	-46	-788	34312
2	62618	H75	8007	-160	-8			-168	7839
2	62618	H37	7500	-150	-7			-157	7343
2	62618	H80	20762	-415	-19			-434	20328
2	62618	H81	4497	-90	-4			-94	4403
			40766	-815	-38	0	0	-853	39913
2	62622	552	2343	-47	-2	-34	-1	-84	2259
			2343	-47	-2	-34	-1	-84	2259
2	62623	H21	4593	-92	-4	0	0	-96	4497
			4593	-92	-4	0	0	-96	4497

xvii



## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS (A-F)
2	62624	H18	9484	-190	-9	-9	-3	-211	9273
2	62624	H19	5039	-101	-5	-106		-106	4933
2	62624	H28	8214	-164	-8	-174	-2	-174	8040
			22737	-455	-22	-491	-5	-491	22246
2	62705	H11	6073	-121	-6	-127		-127	5946
2	62705	H94	18799	-376	-18	-394		-394	18405
			24872	-497	-24	-521	0	-521	24351
2	62709	H95	16994	-340	-16	-358		-358	16636
			16994	-340	-16	-358	0	-358	16636
2	62712	C61	1359	-27	-1	-28		-28	1331
2	62712	H24	6170	-123	-6	-129		-129	6041
			7529	-150	-7	-157	0	-157	7372
2	62716	H70	14072	-281	-13	-307		-307	13765
2	62716	H34	2250	-45	-2	-47		-47	2203
			16322	-326	-15	-354	0	-354	15968
2	62720	048	6072	-121	-6	-127		-127	5945
2	62720	876	7500	-150	-7	-157		-157	7343
2	62720	877	5000	-100	-5	-105		-105	4895
2	62720	822	2000	-40	-2	-42		-42	1958
2	62720	823	5400	-108	-5	-113		-113	5287
2	62720	826	4000	-80	-4	-84		-84	3916
2	62720	829	13170	-263	-12	-275		-275	12895
2	62720	835	3169	-63	-3	-66		-66	3103
2	62720	896	7412	-148	-7	-155		-155	7257
2	62720	F25	2634	-53	-2	-55		-55	2579
			56357	-1126	-53	-1179	0	-1179	55178
2	62782	779	7265	-145	-7	-152		-152	7113
2	62782	H92	8042	-161	-8	-179		-179	7863
			15307	-306	-15	-331	0	-331	14976

xviii

UNCLASSIFIED

## FY97 COLUMN OF FY98/99 PRES BUD

A	B	C	D	E	F	G			
					(B+C+D+E)	(A-F)			
BA	PE	Proj	FY 97 Approp Value	Sec 8136	Sec 8138	Sec 8037 FERDC	Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
2	62783	094	4321	-86	-4			-90	4231
2	62783	Y10	2317	-46	-2			-48	2269
			6638	-132	-6	0	0	-138	6500
2	62784	855	8556	-171	-8			-179	8377
2	62784	H71	6691	-134	-6			-140	6551
2	62784	T40	11403	-228	-11	-24		-263	11140
2	62784	T41	4285	-86	-4			-90	4195
2	62784	T42	5541	-111	-5			-116	5425
2	62784	T45	2422	-48	-2			-50	2372
			38898	-778	-36	-24	0	-838	38060
2	62785	790	3107	-62	-3			-65	3042
2	62785	791	6421	-128	-6			-134	6287
			9528	-190	-9	0	0	-199	9329
2	62786	283	1665	-33	-2			-35	1630
2	62786	C60	3277	-66	-3			-69	3208
2	62786	J10	3000	-60	-3			-63	2937
2	62786	H98	9464	-189	-9	-13	-8	-219	9245
2	62786	H99	4402	-88	-4	-8	-3	-103	4299
			21808	-436	-21	-21	-11	-489	21319
2	62787	825	514	-10	0			-10	504
2	62787	870	29843	-597	-28			-1044	28799
2	62787	873	2931	-59	-3			-62	2869
2	62787	874	11415	-228	-11			-239	11176
2	62787	878	7294	-146	-7			-153	7141
2	62787	879	8693	-174	-8			-182	8511
2	62787	839	2300	-46	-2			-48	2252
2	62787	842	1000	-20	-1			-21	979
2	62787	844	20000	-400	-19			-73	3427
2	62787	843	3500	-70	-3			-52	2448
2	62787	841	2500	-50	-2			-523	24477
2	62787	838	25000	-500	-23			-42	1958
2	62787	863	2000	-40	-2			-209	9791
2	62787	845	10000	-200	-9			-2658	104332
			126990	-2540	-118	0	0		

TRANSFERRED TO DEFENSE HEALTH PROGRAM

xix

## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

	A	B	C	D	E	F (B+C+D+E)	G (A-F)
	FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
2	62789 880	-45	-2	-2	0	-47	2179
	2226	-45	-2	0	0	-47	2179
	<b>TOTAL BA 2</b>	<b>-11680</b>	<b>-549</b>	<b>-183</b>	<b>-111</b>	<b>-12523</b>	<b>551558</b>
3	63001 242	-25	-1			-26	1223
3	63001 543	-62	-3			-65	3032
3	63001 594	-9	0			-9	436
3	63001 C07	-38	-2			-40	1851
3	63001 J28	-5	0			-5	246
3	63001 J50	-326	-15			-341	15936
	23210	-465	-21	0	0	-486	22724
3	63002 806	-2000	-94			-2094	97906
3	63002 810	-185	-9			-194	9034
3	63002 804	-900	-42			-942	44058
3	63002 819	-48	-2			-50	2350
3	63002 893	-240	-11			-251	11749
3	63002 813	-10	0			-10	490
3	63002 818	-70	-3			-73	3427
3	63002 817	-60	-3			-63	2937
3	63002 816	-120	-6			-126	5874
3	63002 815	-120	-6			-126	5874
3	63002 887	-150	-7			-157	7343
3	63002 814	-160	-8			-168	7832
3	63002 840	-47	-2			-49	2324
	205501	-4110	-193	0	0	-4303	201198
3	63003 313	-71	-3			-74	3453
3	63003 391	-101	-5			-106	4934
3	63003 436	-493	-23		-109	-625	24022
3	63003 447	-156	-7			-163	7617
3	63003 A38	-300	-14			-314	14686
3	63003 B38	-1000	-1			-21	979
3	63003 B97	-10	0			-10	474
	57478	-1151	-53	0	-109	-1313	56165
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UNCLASSIFIED

UNCLASSIFIED

ARMY

## FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A FY 97 Approp Value	B Sec 8136	C Sec 8138	D FFRDC	E Sec 8037 Consulting Services	F Tot Adj to Approp Value (B+C+D+E)	G FY 97 Column on RDDS (A-F)
3	63004	232	5772	-115	-5			-120	5652
3	63004	43A	21809	-436	-20			-456	21353
3	63004	L95	2178	-44	-2	-15		-61	2117
			29759	-595	-27	-15	0	-637	29122
3	63005	221	4758	-95	-4			-99	4659
3	63005	440	13507	-270	-13		-123	-406	13101
3	63005	441	4203	-84	-4			-88	4115
3	63005	497	1818	-36	-2			-38	1780
3	63005	502	2000	-40	-2			-42	1958
3	63005	C62	3266	-65	-3			-68	3198
			29552	-590	-28	0	-123	-741	28811
3	63006	247	7427	-149	-7			-156	7271
3	63006	257	11981	-240	-11	-110		-361	11620
3	63006	592	3712	-74	-3			-77	3635
3	63006	596	5000	-100	-5			-105	4895
3	63006	597	2000	-40	-2			-42	1958
			30120	-603	-28	-110	0	-741	29379
3	63007	792	1418	-28	-1			-29	1389
3	63007	793	3082	-62	-3			-65	3017
			4500	-90	-4	0	0	-94	4406
3	63009	B18	17176	-344	-16	-25		-385	16791
			17176	-344	-16	-25	0	-385	16791
3	63013	C25	3335	-67	-3			-70	3265
			3335	-67	-3	0	0	-70	3265
3	63017	B69	8625	-172	-8			-180	8445
			8625	-172	-8	0	0	-180	8445
3	63020	B77	5078	-102	-5			-107	4971
			5078	-102	-5	0	0	-107	4971
3	63105	H29	17919	-358	-17			-375	17544
			17919	-358	-17	0	0	-375	17544

xxi

UNCLASSIFIED

## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
								(B+C+D+E)	(A-F)
3	63238	177	14446	-289	-14	-22	-124	-449	13997
3	63238	546	8212	-164	-8		-28	-200	8012
			22658	-453	-22	-22	-152	-649	22009
3	63270	K15	2913	-58	-3			-61	2852
3	63270	K16	3881	-78	-4			-82	3799
			6794	-136	-7	0	0	-143	6651
3	63313	206	1	0	0			0	1
3	63313	703	9000	-180	-8			-188	8812
3	63313	263	9745	-195	-9			-204	9541
3	63313	380	13515	-270	-13			-283	13232
3	63313	387	639	-13	-1			-14	625
3	63313	486	7849	-157	-7	-29		-193	7656
3	63313	493	24245	-485	-23			-508	23737
3	63313	496	37042	-741	-35	-18	-34	-828	36214
3	63313	550	1	0	0			0	1
			102037	-2041	-96	-47	-34	-2218	99819
3	63322	B92	8851	-177	-8		-15	-200	8651
			8851	-177	-8	0	-15	-200	8651
3	63606	608	23296	-466	-22	-67	-7	-562	22734
3	63606	624	5000	-100	-5			-105	4895
			28296	-566	-27	-67	-7	-667	27629
3	63607	627	8243	-165	-8			-173	8070
3	63607	664	1000	-20	-1			-21	979
			9243	-185	-9	0	0	-194	9049
3	63654	460	10000	-200	-9			-209	9791
			10000	-200	-9	0	0	-209	9791
3	63710	C63	2224	-44	-2			-46	2178
3	63710	K70	11425	-228	-11			-239	11186
3	63710	K86	5566	-111	-5			-116	5450
3	63710	K87	11182	-224	-11			-235	10947
			30397	-607	-29	0	0	-636	29761

xxiii

UNCLASSIFIED

UNCLASSIFIED

ARMY

## FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
								(B+C+D+E)	(A-F)
3	63734	T08	1456	-29	-1			-30	1426
3	63734	T10	9585	-192	-9			-201	9384
3	63734	T12	9623	-192	-9	-19		-220	9403
			20664	-413	-19	-19	0	-451	20213
3	63772	101	13988	-280	-13	-265		-558	13430
3	63772	243	975	-19	-1			-20	955
3	63772	281	7136	-143	-7	-51	-38	-239	6897
			22099	-442	-21	-316	-38	-817	21282
		TOTAL BA 3	693292	-13867	-650	-621	-478	-15616	677676
4	63018	B89	2409	-48	-2	-30		-80	2329
			2409	-48	-2	-30	0	-80	2329
4	63308	990	2884	-58	-3			-61	2823
4	63308	989	45000	-900	-42			-942	44058
4	63308	997	20000	-400	-19			-419	19581
			67884	-1358	-64	0	0	-1422	66462
4	63619	606	28464	-569	-27		-8	-604	27860
			28464	-569	-27	0	-8	-604	27860
4	63627	E79	6380	-128	-6			-134	6246
			6380	-128	-6	0	0	-134	6246
4	63639	643	46561	-931	-44		-5	-980	45581
4	63639	656	18160	-363	-17	-7		-387	17773
			64721	-1294	-61	-7	-5	-1367	63354
4	63640	B91	8500	-170	-8			-178	8322
			8500	-170	-8	0	0	-178	8322
4	63645	Q19	8000	-160	-8	-29		-197	7803
			8000	-160	-8	-29	0	-197	7803
4	63653	B99	11639	-233	-11			-244	11395
			11639	-233	-11	0	0	-244	11395
					xxiii				

UNCLASSIFIED

## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
4	63713	2QT	3653	-73	-3		-39	-115	3538
4	63713	370	20169	-403	-19		-2	-424	19745
			23822	-476	-22	0	-41	-539	23283
4	63745	535	4025	-80	-4			-84	3941
			4025	-80	-4	0	0	-84	3941
4	63747	610	1946	-39	-2			-41	1905
4	63747	669	3418	-68	-3			-71	3347
4	63747	C09	1316	-26	-1			-27	1289
			6680	-133	-6	0	0	-139	6541
4	63766	907	26060	-521	-24	-17	-144	-706	25354
			26060	-521	-24	-17	-144	-706	25354
4	63774	131	2829	-57	-3			-60	2769
			2829	-57	-3	0	0	-60	2769
4	63790	691	9963	-199	-9			-208	9755
			9963	-199	-9	0	0	-208	9755
4	63801	B32	2228	-45	-2			-47	2181
4	63801	B33	2053	-41	-2			-43	2010
4	63801	B45	9104	-182	-9			-191	8913
			13385	-268	-13	0	0	-281	13104
4	63804	266	1444	-29	-1			-30	1414
4	63804	428	3951	-79	-4			-83	3868
4	63804	G10	132	-3	0			-3	129
4	63804	G11	217	-4	0			-4	213
4	63804	G14	88	-2	0			-2	86
4	63804	K39	869	-17	-1			-18	851
4	63804	K41	891	-18	-1			-19	872
			7592	-152	-7	0	0	-159	7433
4	63805	091	11119	-222	-10	-3		-235	10884
4	63805	246	2021	-40	-2	-61		-103	1918
			13140	-262	-12	-64	0	-338	12802

xxiv

UNCLASSIFIED

UNCLASSIFIED

ARMY

## FY97 COLUMN OF FY98/99 PRES BUD

	A	B	C	D	E	F (B+C+D+E)	G (A-F)
	FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
BA PE Proj							
4 63807 808	3835	-77	-4			-81	3754
4 63807 811	2636	-53	-2			-55	2581
4 63807 836	2905	-58	-3			-61	2844
4 63807 837	835	-17	-1			-18	817
	10211	-205	-10	0	0	-215	9996
4 63851 C75	3124	-62	-3	-48	-10	-123	3001
	3124	-62	-3	-48	-10	-123	3001
4 63854 505	240916	-4818	-226		-77	-5121	235795
4 63854 C68	2855	-57	-3			-60	2795
	243771	-4875	-229	0	-77	-5181	238590
4 63856 389	8080	-162	-8			-170	7910
	8080	-162	-8	0	0	-170	7910
TOTAL BA 4	570679	-11412	-537	-195	-285	-12429	558250
5 64201 C97	15008	-300	-14			-314	14694
	15008	-300	-14	0	0	-314	14694
5 64220 538	1154	-23	-1			-24	1130
	1154	-23	-1	0	0	-24	1130
5 64223 327	296528	-5930	-278		-130	-6338	290190
5 64223 C72	42116	-842	-40			-882	41234
	338644	-6772	-318	0	-130	-7220	331424
5 64270 665	44579	-892	-42			-934	43645
5 64270 L12	16414	-328	-15	-6		-349	16065
5 64270 L15	3845	-77	-4			-81	3764
5 64270 L16	1288	-26	-1			-27	1261
5 64270 L18	9348	-187	-9		-1	-197	9151
	75474	-1510	-71	-6	-1	-1588	73886
5 64321 2FT	3767	-75	-4		-40	-119	3648
5 64321 B19	36433	-729	-34	-10		-773	35660
	40200	-804	-38	-10	-40	-892	39308

XXV

UNCLASSIFIED



UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

A		B	C	D	E	F	G	
FY 97		Sec 8037					FY 97	
BA	PE	Proj	Sec 8136	Sec 8138	FFRDC	Consulting Services	Tot Adj to Approp Value	Column on RDDS
Approp Value							(B+C+D+E)	(A-F)
5	64325	E18	-112	-5	0	0	-117	5479
			-112	-5			-117	5479
5	64328	C71	-31	-1	0	-5	-37	1524
			-31	-1	0	-5	-37	1524
5	64604	H07	-120	-6	0	0	-126	5874
			-120	-6	0	0	-126	5874
5	64611	499	-123	-6	0	0	-129	6014
			-123	-6	0	0	-129	6014
5	64619	088	-538	-25	-41	-17	-621	26288
			-538	-25	-41	-17	-621	26288
5	64622	659	-40	-2	0	0	-42	1958
			-40	-2	0	0	-42	1958
5	64633	586	-151	-7	0	-14	-172	7377
			-151	-7	0	-14	-172	7377
5	64640	G27	-158	-7	0	0	-165	7734
			-158	-7	0	0	-165	7734
5	64641	E47	-58	-3	0	0	-61	2823
			-58	-3	0	0	-61	2823
5	64642	E40	-60	-3	0	0	-63	2937
			-60	-3	0	0	-63	2937
5	64645	175	-135	-6	0	0	-141	6585
			-135	-6	0	0	-141	6585
5	64649	G25	-697	-33		-5	-735	34102
5	64649	G26	-257	-12		-1	-270	12603
			-954	-45	0	-6	-1005	46705

xxvi

UNCLASSIFIED

UNCLASSIFIED

ARMY

## FY97 COLUMN OF FY98/99 PRES BUD

A		B	C	D	E	F	G		
						(B+C+D+E)	(A-F)		
BA	PE	Proj	FY 97 Approp Value	Sec 8136	Sec 8138	Sec 8037 FERDC	Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
5	64710	L69	18443	-369	-17	-8	-13	-407	18036
5	64710	L70	9482	-190	-9			-199	9283
5	64710	L74	7712	-154	-7			-161	7551
			35637	-713	-33	-8	-13	-767	34870
5	64713	548	809	-16	-1			-17	792
5	64713	667	48917	-978	-46			-1024	47893
5	64713	668	21598	-432	-20			-452	21146
5	64713	C40	1784	-36	-2			-38	1746
5	64713	L40	4955	-99	-5			-104	4851
			78063	-1561	-74	0	0	-1635	76428
5	64715	241	36752	-735	-35	-31		-801	35951
5	64715	396	2781	-56	-3			-59	2722
5	64715	573	10332	-207	-10			-217	10115
			49865	-998	-48	-31	0	-1077	48788
5	64716	579	7369	-147	-7	-50	-21	-225	7144
			7369	-147	-7	-50	-21	-225	7144
5	64739	702	4867	-97	-5	0	0	-102	4765
			4867	-97	-5	0	0	-102	4765
5	64741	126	20516	-410	-19	-9	-47	-485	20031
			20516	-410	-19	-9	-47	-485	20031
5	64746	L59	9793	-196	-9	-10	-3	-218	9575
			9793	-196	-9	-10	-3	-218	9575
5	64760	C73	10248	-205	-10			-215	10033
5	64760	C74	2632	-53	-2			-55	2577
5	64760	C77	3086	-62	-3			-65	3021
			15966	-320	-15	0	0	-335	15631
5	64766	909	15758	-315	-15	-136	-57	-523	15235
			15758	-315	-15	-136	-57	-523	15235

xxvii

UNCLASSIFIED

UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS (A-F)
5	64768	2NT	5	0	0			0	5
5	64768	641	68622	-1372	-64			-1436	67186
5	64768	687	19221	-384	-18			-402	18819
5	64768	688	77559	-1551	-73		-129	-1753	75806
			165407	-3307	-155	0	-129	-3591	161816
5	64770	202	9857	-197	-9	-12	-15	-233	9624
			9857	-197	-9	-12	-15	-233	9624
5	64778	168	437	-9	0	0	0	-9	428
			437	-9	0	0	0	-9	428
5	64780	571	26713	-534	-25	-44		-603	26110
			26713	-534	-25	-44	0	-603	26110
5	64801	C45	5518	-110	-5	0	0	-115	5403
			5518	-110	-5	0	0	-115	5403
5	64802	284	14108	-282	-13			-295	13813
5	64802	AS1	1600	-32	-2			-34	1566
5	64802	531	5176	-104	-5			-109	5067
5	64802	712	3284	-66	-3			-69	3215
			24168	-484	-23	0	0	-507	23661
5	64804	194	2230	-45	-2			-47	2183
5	64804	279	1444	-29	-1			-30	1414
5	64804	429	3261	-65	-3			-68	3193
5	64804	H01	9635	-193	-9			-202	9433
5	64804	H14	88	-2	0			-2	86
5	64804	L39	1677	-34	-2			-36	1641
5	64804	L41	1033	-21	-1			-22	1011
5	64804	L42	962	-19	-1			-20	942
			20330	-408	-19	0	0	-427	19903

xxviii

UNCLASSIFIED

UNCLASSIFIED

ARMY

## FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
5	64805	097	1715	-34	-2	-19		-55	1660
5	64805	098	569	-11	-1	-15		-27	542
5	64805	282	7031	-141	-7			-148	6883
5	64805	485	481	-10	0			-10	471
			9796	-196	-10	-34	0	-240	9556
5	64807	812	193	-4	0			-4	189
5	64807	832	1695	-34	-2			-36	1659
5	64807	834	884	-18	-1			-19	865
5	64807	849	2022	-40	-2			-42	1980
			4794	-96	-5	0	0	-101	4693
5	64808	016	5499	-110	-5			-115	5384
5	64808	415	2232	-45	-2	-5	-8	-60	2172
			7731	-155	-7	-5	-8	-175	7556
5	64814	2ST	309	-6	0		-3	-9	300
5	64814	644	9840	-197	-9			-206	9634
			10149	-203	-9	0	-3	-215	9934
5	64816	C87	5872	-117	-6			-123	5749
5	64816	C31	5000	-100	-5			-105	4895
			10872	-217	-11	0	0	-228	10644
5	64817	482	13886	-278	-13		-20	-311	13575
5	64817	901	2897	-58	-3			-61	2836
			16783	-336	-16	0	-20	-372	16411
5	64818	323	7784	-156	-7			-163	7621
5	64818	C34	8645	-173	-8	-290	-15	-486	8159
			16429	-329	-15	-290	-15	-649	15780
5	64823	L85	2551	-51	-2		-2	-55	2496
			2551	-51	-2	0	-2	-55	2496

xxix

UNCLASSIFIED

**ARMY**  
**FY97 COLUMN OF FY98/99 PRES BUD**

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XXX

UNCLASSIFIED



UNCLASSIFIED

**ARMY**  
**FY97 COLUMN OF FY98/99 PRES BUD**

<b>BA</b>	<b>PE</b>	<b>Proj</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	
			<b>FY 97</b>	<b>Sec 8136</b>	<b>Sec 8138</b>	<b>FFRDC</b>	<b>Sec 8037</b>	<b>Consulting</b>	<b>Tot Adj to</b>	<b>FY 97</b>
			<b>Approp</b>					<b>Services</b>	<b>Approp</b>	<b>Column</b>
			<b>Value</b>						<b>Value</b>	<b>on RDDS</b>
										<b>(A-F)</b>
6	65801	M02	7355	-147	-7				-154	7201
6	65801	M15	3780	-76	-4				-80	3700
6	65801	M16	4045	-81	-4				-85	3960
6	65801	M42	5641	-113	-5				-118	5523
6	65801	M43	5002	-100	-5				-105	4897
6	65801	M44	5969	-119	-6				-125	5844
6	65801	M45	5487	-110	-5	-3		-1	-119	5368
6	65801	M46	2260	-45	-2				-47	2213
6	65801	M47	2632	-53	-2				-55	2577
6	65801	M53	12565	-251	-12	-85		-14	-362	12203
6	65801	M55	3179	-64	-3				-67	3112
6	65801	M58	390	-8	0				-8	382
6	65801	M75	2787	-56	-3				-59	2728
6	65801		61092	-1223	-58	-88		-15	-1384	59708
6	65802	798	1566	-31	-1				-32	1534
			1566	-31	-1	0		0	-32	1534
6	65803	720	2626	-53	-2			-9	-64	2562
6	65803	727	2870	-57	-3			-5	-65	2805
6	65803	729	2309	-46	-2				-48	2261
6	65803	730	3448	-69	-3				-72	3376
6	65803	733	2180	-44	-2				-46	2134
6	65803	C16	2798	-56	-3				-59	2739
6	65803	C18	690	-14	-1				-15	675
			16921	-339	-16	0		-14	-369	16552
6	65805	296	682	-14	-1				-15	667
6	65805	857	589	-12	-1				-13	576
6	65805	F21	280	-6	0				-6	274
6	65805	F24	1731	-35	-2				-37	1694
			3282	-67	-4	0		0	-71	3211
6	65853	0CC	1498	-30	-1				-31	1467
6	65853	1CC	115	-2	0				-2	113
6	65853	5CC	146	-3	0				-3	143
			1759	-35	-1	0		0	-36	1723

xxxii

UNCLASSIFIED

## FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
6	65854	OPP	546	-11	-1			-12	534
6	65854	IPP	143	-3	0			-3	140
6	65854	5PP	1957	-39	-2			-41	1916
6	65854	7PP	799	-16	-1			-17	782
6	65854	8PP	10449	-209	-10			-219	10230
			13894	-278	-14	0	0	-292	13602
6	65856	0VV	34856	-697	-33			-730	34126
6	65856	1VV	13972	-279	-13			-292	13680
6	65856	4VV	1500	-30	-1			-31	1469
6	65856	5VV	5083	-102	-5			-107	4976
			55411	-1108	-52	0	0	-1160	54251
6	65876	0WW	2766	-55	-3			-58	2708
6	65876	1WW	1062	-21	-1			-22	1040
6	65876	4WW	491	-10	0			-10	481
			4319	-86	-4	0	0	-90	4229
6	65878	0YY	50862	-1017	-48			-1065	49797
6	65878	1YY	15807	-316	-15			-331	15476
6	65878	4YY	3378	-68	-3			-71	3307
			70047	-1401	-66	0	0	-1467	68580
6	65879	0UU	62918	-1258	-59			-1317	61601
6	65879	1UU	24858	-497	-23			-520	24338
6	65879	4UU	4614	-92	-4			-96	4518
			92390	-1847	-86	0	0	-1933	90457
6	65896	0ZZ	148139	-2963	-138			-3101	145038
6	65896	1ZZ	64068	-1281	-60			-1341	62727
6	65896	4ZZ	12442	-249	-12			-261	12181
			224649	-4493	-210	0	0	-4703	219946
6	65898	M65	4801	-96	-5			-101	4700
6	65898	831	14000	-280	-13			-293	13707
			18801	-376	-18	0	0	-394	18407
		TOTAL BA 6	1095744	-21916	-1029	-377	-257	-23579	1072165

xxxiii



## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

A	B	C	D	E	F (B+C+D+E)	G (A-F)			
BA	PE	Proj	FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
7	63778	027	27038	-541	-25		-50	-616	26422
7	63778	050	26324	-526	-25			-551	25773
7	63778	054	10909	-218	-10			-228	10681
			64271	-1285	-60	0	-50	-1395	62876
7	12419	E55	26940	-539	-25			-564	26376
			26940	-539	-25	0	0	-564	26376
7	23726	2ET	4933	-99	-5		-52	-156	4777
7	23726	322	34564	-691	-32	-42	-64	-829	33735
			39497	-790	-37	-42	-116	-985	38512
7	23735	280	3116	-62	-3			-65	3051
7	23735	2TT	2079	-42	-2		-22	-66	2013
7	23735	2UT	1460	-29	-1		-15	-45	1415
7	23735	330	71246	-1425	-67		-5	-1497	69749
7	23735	344	18298	-366	-17			-383	17915
7	23735	371	89635	-1793	-84		-5	-1882	87753
7	23735	718	11900	-238	-11			-249	11651
7	23735	C64	13562	-271	-13		-9	-293	13269
			211296	-4226	-198	0	-56	-4480	206816
7	23740	2HT	3895	-78	-4		-41	-123	3772
7	23740	484	25187	-504	-24	-491	-52	-1071	24116
			29082	-582	-28	-491	-93	-1194	27888
7	23744	430	17914	-358	-17			-375	17539
7	23744	504	250	-5	0			-5	245
7	23744	179	4700	-94	-4			-98	4602
			22864	-457	-21	0	0	-478	22386
7	23752	106	3947	-79	-4		-30	-113	3834
			3947	-79	-4	0	-30	-113	3834
7	23758	374	90180	-1803	-85	-112	-55	-2055	88125
7	23758	376	50000	-1000	-47			-1047	48953
			140180	-2803	-132	-112	-55	-3102	137078

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A	B	C	D	E	F (B+C+D+E)	G (A-F)
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71	1	1	1	1		

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## UNCLASSIFIED

ARMY  
FY97 COLUMN OF FY98/99 PRES BUD

BA	PE	Proj	A	B	C	D	E	F	G
			FY 97 Approp Value	Sec 8136	Sec 8138	FFRDC	Sec 8037 Consulting Services	Tot Adj to Approp Value	FY 97 Column on RDDS
7	33150	C86	19804 19804	-396 -396	-19 -19	0	0	-415 -415	19389 19389
7	35128	H12	487 487	-10 -10	0 0	0	0	-10 -10	477 477
7	78045	E25	48842 48842	-977 -977	-46 -46	0	0	-1023 -1023	47819 47819
TOTAL BA 7			769220	-15385	-722	-1634	-718	-18459	750761
			5062763	-101257	-4757	-3718	-2403	-112135	4930628

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#1 - BASIC RESEARCH			
1	0601101A	In-House Laboratory Independent Research	1
2	0601102A	Defense Research Sciences	10
3	0601104A	University and Industry Research Centers	76
#2 - EXPLORATORY DEVELOPMENT			
4	0602105A	Materials Technology	101
5	0602120A	Sensors and Electronic Survivability	104
6	0602211A	Aviation Technology	115
7	0602270A	Electronic Warfare (EW) Technology	124
8	0602303A	Missile Technology	131
9	0602308A	Modeling and Simulation Technology	137
10	0602601A	Combat Vehicle and Automotive Technology	143
11	0602618A	Ballistics Technology	159
12	0602622A	Chemical, Smoke and Equipment Defeating Technology	168
13	0602623A	Joint Service Small Arms Program	170
14	0602624A	Weapons and Munitions Technology	173
15	0602705A	Electronics and Electronic Devices	183
16	0602709A	Night Vision Technology	191
17	0602712A	Countermine Applied Research	194
18	0602716A	Human Factors Engineering Technology	198
19	0602720A	Environmental Quality Technology	205
20	0602782A	Command, Control, Communications Technology	224
21	0602783A	Computer and Software Technology	230
22	0602784A	Military Engineering Technology	235
23	0602785A	Manpower/Personnel/Training Technology	250

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#2 - EXPLORATORY DEVELOPMENT - Continued			
24	0602786A	Logistics Technology	255
25	0602787A	Medical Technology	269
26	0602789A	Army Artificial Intelligence Technology	294
#3 - ADVANCED DEVELOPMENT			
27	0603001A	Logistics Advanced Technology	296
28	0603002A	Medical Advanced Technology	314
29	0603003A	Aviation Advanced Technology	334
30	0603004A	Weapons and Munitions Advanced Technology	346
31	0603005A	Combat Vehicle and Automotive Advanced Technology	355
32	0603006A	Command, Control and Communications Advanced Technology	367
33	0603007A	Manpower, Personnel and Training Advanced Technology	381
34	0603105A	Military Human Immunodeficiency Virus (HIV) Research	386
35	0603238A	Air Defense/Precision Strike Technology	388
36	0603270A	Electronic Warfare (EW) Technology	394
37	0603313A	Missile and Rocket Advanced Technology	399
38	0603606A	Landmine Warfare and Barrier Advanced Technology	427
39	0603607A	Joint Service Small Arms Program	433
40	0603654A	Line-of-Sight Technology Demonstration	437
41	0603710A	Night Vision Advanced Technology	440
42	0603734A	Military Engineering Advanced Technology	447
43	0603772A	Advanced Tactical Computer Science and Sensor Technology	455

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#4 - DEMONSTRATION AND VALIDATION			
44	0603308A	Army Missile Defense Systems Integration	463
45	0603619A	Landmine Warfare and Barrier - Advanced Development	473
46	0603627A	Smoke, Obscurant and Target Defeating System - Advanced Development	482
47	0603640A	Artillery Propellant Development	486
48	0603645A	Armored Systems Modernization - Advanced Development	490
49	0603649A	Engineering Modification Equipment - Advanced Development	506
50	0603653A	Advanced Tank Armament System	510
51	0603713A	Army Data Distribution System	515
52	0603745A	Tactical Electronic Support Systems - Advanced Development (TIARA)	524
53	0603747A	Soldier Support and Survivability	528
54	0603766A	Tactical Exploitation of National Capabilities (TENCAP) - Dem/Val (TIARA)	544
55	0603774A	Night Vision Systems - Advanced Development	549
56	0603790A	NATO Research & Development	554
57	0603801A	Aviation - Advanced Development	565
58	0603802A	Weapons and Munitions - Advanced Development	580
59	0603804A	Logistics and Engineering Equipment - Advanced Development	583
60	0603805A	Combat Service Support Control Systems Evaluation and Analysis	613
61	0603807A	Medical Systems - Advanced Development	622
62	0603854A	Artillery Systems Advanced Development	638
63	0603856A	SCAMP BLK II (SPACE)	644
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT			
64	0604201A	Aircraft Avionics	647
65	0604220A	Armed, Deployable OH-58D	653
66	0604223A	Comanche	656

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
67	0604270A	Electronic Warfare (EW) Development	666
68	0604321A	All Source Analysis System (TIARA)	694
69	0604325A	Follow-On To TOW	703
70	0604604A	Medium Tactical Vehicles	706
71	0604609A	Smoke, Obscurant and Target Defeating System - Engineering Development	711
72	0604611A	Javelin	715
73	0604619A	Landmine Warfare	719
74	0604622A	Family of Heavy Tactical Vehicles	723
75	0604633A	Air Traffic Control	730
76	0604640A	Advanced Command and Control Vehicle	735
77	0604641A	Tactical Unmanned Ground Vehicle	739
78	0604642A	Light Tactical Wheeled Vehicle	743
79	0604645A	Armored Systems Modernization (ASM) - Engineering Development	750
80	0604649A	Engineer Mobility Equipment Development	759
81	0604710A	Night Vision Systems - Engineering Development	770
82	0604713A	Combat Feeding, Clothing, and Equipment	785
83	0604715A	Non-System Training Devices - Engineering Development	812
84	0604716A	Terrain Information - Engineering Development (TIARA)	830
85	0604726A	Integrated Meteorological System (IMETS) (TIARA)	835
86	0604739A	JTT/CIBS-M (TIARA)	839
87	0604740A	Tactical Surveillance System - Engineering Development	842
88	0604741A	Air Defense Command, Control, Intelligence - Engineering Development	845
89	0604746A	Automatic Test Equipment Development	852
90	0604760A	Distributive Interactive Simulations - Engineering Development	861
91	0604766A	Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	876

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#5 - ENGINEERING AND MANUFACTURING DEVELOPMENT - Continued			
92	0604768A	Brilliant Anti-Armor (BAT) Submunition	881
93	0604770A	Joint Surveillance/Target Attack Radar System	900
94	0604778A	Positioning Systems Development (SPACE)	909
95	0604780A	Combined Arms Tactical Trainer (CATT)	912
96	0604801A	Aviation - Engineering Development	917
97	0604802A	Weapons and Munitions - Engineering Development	923
98	0604804A	Logistics & Engineer Equipment - Engineering Development	947
99	0604805A	Command, Control, Communications Systems - Engineering Development	990
100	0604807A	Medical Materiel - Engineering Development	1009
101	0604808A	Landmine Warfare/Barrier - Engineering Development	1024
102	0604814A	Sense and Destroy Armor Munition - Engineering Development	1032
103	0604816A	Longbow	1041
104	0604817A	Combat Identification - Engineering & Manufacturing Development	1050
105	0604818A	Army Tactical Command and Control Hardware & Software	1062
106	0604820A	Radar Development	1071
107	0604823A	Firefinder	1074
108	0604854A	Artillery Systems - Engineering Development	1079
#6 - MANAGEMENT SUPPORT			
109	0604256A	Threat Simulator Development	1086
110	0604258A	Target Systems Development	1089
111	0604759A	Major Test and Evaluation Investment	1095
112	0605103A	Rand Arroyo Center	1104
113	0605301A	Army Kwajalein Atoll	1108
114	0605601A	Army Test Ranges and Facilities	1111



# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#6 - MANAGEMENT SUPPORT - Continued			
115	0605602A	Army Test Technology and Sustaining Instrumentation	1131
116	0605604A	Survivability/Lethality Analysis	1138
117	0605605A	DOD High Energy Laser System Test Facility (HELSTF)	1158
118	0605606A	Aircraft Certification	1160
119	0605702A	Meteorological Support to Research, Development, Testing & Evaluation Activities	1162
120	0605706A	Matériel Systems Analysis	1165
121	0605709A	Exploitation of Foreign Items	1174
122	0605712A	Support of Operational Testing	1179
123	0605801A	Programwide Activities	1196
124	0605802A	International Cooperative Research and Development	1201
125	0605803A	Technical Information Activities	1203
126	0605805A	Munitions Standardization Effectiveness and Safety	1220
127	0605853A	Environmental Conservation	1230
128	0605854A	Pollution Prevention	1236
129	0605856A	Environmental Compliance - Research, Development, Testing & Evaluation	1246
130	0605876A	Minor Construction - Research, Development, Testing & Evaluation	1254
131	0605878A	Maintenance and Repair - Research, Development, Testing & Evaluation	1261
132	0605879A	Real Property Services (RPS)	1269
133	0605896A	Base Operations - Research, Development, Testing & Evaluation	1276
134	0605898A	Management Headquarters (Research and Development)	1284
#7 - OPERATIONAL SYSTEM DEVELOPMENT			
135	0102419A	Aerostat Joint Program Office	1289
136	0203726A	Advanced Field Artillery Tactical Data System	1294
137	0203735A	Combat Vehicle Improvement Programs	1303

# TABLE OF CONTENTS

BA	PE	Program Element Title	PAGE
#7 - OPERATIONAL SYSTEM DEVELOPMENT - Continued			
138	0203740A	Maneuver Control System	1332
139	0203744A	Aircraft Modifications/Product Improvement Program	1345
140	0203752A	Aircraft Engine Component Improvement Program	1357
141	0203758A	Digitization	1362
142	0203801A	Missile/Air Defense Product Improvement Program	1372
143	0203802A	Other Missile Product Improvement Programs	1383
144	0208010A	Joint Tactical Communications Program (TRI-TAC)	1407
145	0208053A	Joint Tactical Ground System (TIARA)	1411
146	0303140A	Communications Security (COMSEC) Equipment	1414
147	0303142A	Satellite Communications (SATCOM) Ground Environment (SPACE)	1423
148	0303150A	Army Global Command and Control System (AGCCS)	1456
149	0305114A	Joint Precision Approach Landing System (JPALS)	1461
150	0305128A	Security and Intelligence Activities	1464
151	0603778A	Multiple Launch Rocket System Product Improvement Program	1467
152	0708045A	Army Industrial Preparedness Manufacturing Technology	1486
153	1001018A	NATO Joint STARS	1498

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Advanced Command and Control Vehicle	0604640A	735
Advanced Field Artillery Tactical Data System	0203726A	1294
Advanced Tactical Computer Science and Sensor Technology	0603772A	455
Advanced Tank Armament System	0603653A	510
Aerostat Joint Program Office	0102419A	1289
Air Defense Command, Control, Intelligence - Engineering Development	0604741A	845
Air Defense/Precision Strike Technology	0603238A	388
Air Traffic Control	0604633A	730
Aircraft Avionics	0604201A	647
Aircraft Certification	0605606A	1160
Aircraft Engine Component Improvement Program	0203752A	1357
Aircraft Modifications/Product Improvement Program	0203744A	1345
All Source Analysis System (TIARA)	0604321A	694
Armed, Deployable OH-58D	0604220A	653
Armored Systems Modernization (ASM) - Engineering Development	0604645A	750
Armored Systems Modernization - Advanced Development	0603645A	490
Army Artificial Intelligence Technology	0602789A	294
Army Data Distribution System	0603713A	515
Army Global Command and Control System (AGCCS)	0303150A	1456
Army Industrial Preparedness Manufacturing Technology	0708045A	1486
Army Kwajalein Atoll	0605301A	1108
Army Missile Defense Systems Integration	0603308A	463
Army Tactical Command and Control Hardware & Software	0604818A	1062
Army Test Ranges and Facilities	0605601A	1111
Army Test Technology and Sustaining Instrumentation	0605602A	1131

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Artillery Propellant Development	0603640A	486
Artillery Systems - Engineering Development	0604854A	1079
Artillery Systems Advanced Development	0603854A	638
Automatic Test Equipment Development	0604746A	852
Aviation - Advanced Development	0603801A	565
Aviation - Engineering Development	0604801A	917
Aviation Advanced Technology	0603003A	334
Aviation Technology	0602211A	115
Ballistics Technology	0602618A	159
Base Operations - Research, Development, Testing & Evaluation	0605896A	1276
Brilliant Anti-Armor (BAT) Submunition	0604768A	881
Chemical, Smoke and Equipment Defeating Technology	0602622A	168
Comanche	0604223A	656
Combat Feeding, Clothing, and Equipment	0604713A	785
Combat Identification - Engineering & Manufacturing Development	0604817A	1050
Combat Service Support Control Systems Evaluation and Analysis	0603805A	613
Combat Vehicle and Automotive Advanced Technology	0603005A	355
Combat Vehicle and Automotive Technology	0602601A	143
Combat Vehicle Improvement Programs	0203735A	1303
Combined Arms Tactical Trainer (CATT)	0604780A	912
Command, Control and Communications Advanced Technology	0603006A	367
Command, Control, Communications Systems - Engineering Development	0604805A	990
Command, Control, Communications Technology	0602782A	224
Communications Security (COMSEC) Equipment	0303140A	1414
Computer and Software Technology	0602783A	230

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Countermine Applied Research	0602712A	194
Defense Research Sciences	0601102A	10
Digitization	0203758A	1362
Distributive Interactive Simulations - Engineering Development	0604760A	861
DOD High Energy Laser System Test Facility (HELSTF)	0605605A	1158
Electronic Warfare (EW) Technology	0603270A	394
Electronic Warfare (EW) Technology	0602270A	124
Electronic Warfare (EW) Development	0604270A	666
Electronics and Electronic Devices	0602705A	183
Engineer Mobility Equipment Development	0604649A	759
Engineering Modification Equipment - Advanced Development	0603649A	506
Environmental Compliance - Research, Development, Testing & Evaluation	0605856A	1246
Environmental Conservation	0605853A	1230
Environmental Quality Technology	0602720A	205
Exploitation of Foreign Items	0605709A	1174
Family of Heavy Tactical Vehicles	0604622A	723
Firefinder	0604823A	1074
Follow-On To TOW	0604325A	703
Human Factors Engineering Technology	0602716A	198
In-House Laboratory Independent Research	0601101A	1
Integrated Meteorological System (IMETS) (TIARA)	0604726A	835
International Cooperative Research and Development	0605802A	1201
Javelin	0604611A	715
Joint Precision Approach Landing System (JPALS)	0305114A	1461
Joint Service Small Arms Program	0603607A	433

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Joint Service Small Arms Program	0602623A	170
Joint Surveillance/Target Attack Radar System	0604770A	900
Joint Tactical Communications Program (TRI-TAC)	0208010A	1407
Joint Tactical Ground System (TIARA)	0208053A	1411
JTT/CIBS-M (TIARA)	0604739A	839
Landmine Warfare	0604619A	719
Landmine Warfare and Barrier - Advanced Development	0603619A	473
Landmine Warfare and Barrier Advanced Technology	0603606A	427
Landmine Warfare/Barrier - Engineering Development	0604808A	1024
Light Tactical Wheeled Vehicle	0604642A	743
Line-of-Sight Technology Demonstration	0603654A	437
Logistics & Engineer Equipment - Engineering Development	0604804A	947
Logistics Advanced Technology	0603001A	296
Logistics and Engineering Equipment - Advanced Development	0603804A	583
Logistics Technology	0602786A	255
Longbow	0604816A	1041
Maintenance and Repair - Research, Development, Testing & Evaluation	0605878A	1261
Major Test and Evaluation Investment	0604759A	1095
Management Headquarters (Research and Development)	0605898A	1284
Maneuver Control System	0203740A	1332
Manpower, Personnel and Training Advanced Technology	0603007A	381
Manpower/Personnel/Training Technology	0602785A	250
Materials Technology	0602105A	101
Material Systems Analysis	0605706A	1165
Medical Advanced Technology	0603002A	314

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Medical Materiel - Engineering Development	0604807A	1009
Medical Systems - Advanced Development	0603807A	622
Medical Technology	0602787A	269
Medium Tactical Vehicles	0604604A	706
Meteorological Support to Research, Development, Testing & Evaluation Activities	0605702A	1162
Military Engineering Advanced Technology	0603734A	447
Military Engineering Technology	0602784A	235
Military Human Immunodeficiency Virus (HIV) Research	0603105A	386
Minor Construction - Research, Development, Testing & Evaluation	0605876A	1254
Missile and Rocket Advanced Technology	0603313A	399
Missile Technology	0602303A	131
Missile/Air Defense Product Improvement Program	0203801A	1372
Modeling and Simulation Technology	0602308A	137
Multiple Launch Rocket System Product Improvement Program	0603778A	1467
Munitions Standardization Effectiveness and Safety	0605805A	1220
NATO Joint STARS	1001018A	1498
NATO Research & Development	0603790A	554
Night Vision Advanced Technology	0603710A	440
Night Vision Systems - Advanced Development	0603774A	549
Night Vision Systems - Engineering Development	0604710A	770
Night Vision Technology	0602709A	191
Non-System Training Devices - Engineering Development	0604715A	812
Other Missile Product Improvement Programs	0203802A	1383
Pollution Prevention	0605854A	1236
Positioning Systems Development (SPACE)	0604778A	909

# ALPHABETICAL LISTING

Program Element Title	PE	PAGE
Programwide Activities	0605801A	1196
Radar Development	0604820A	1071
Rand Arroyo Center	0605103A	1104
Real Property Services (RPS)	0605879A	1269
Satellite Communications (SATCOM) Ground Environment (SPACE)	0303142A	1423
SCAMP BLK II (SPACE)	0603856A	644
Security and Intelligence Activities	0305128A	1464
Sense and Destroy Armor Munition - Engineering Development	0604814A	1032
Sensors and Electronic Survivability	0602120A	104
Smoke, Obscurant and Target Defeating System - Advanced Development	0603627A	482
Smoke, Obscurant and Target Defeating System - Engineering Development	0604609A	711
Soldier Support and Survivability	0603747A	528
Support of Operational Testing	0605712A	1179
Survivability/Lethality Analysis	0605604A	1138
Tactical Electronic Support Systems - Advanced Development (TIARA)	0603745A	524
Tactical Exploitation of National Capabilities (TENCAP) - Dem/Val (TIARA)	0603766A	544
Tactical Exploitation of National Capabilities (TENCAP) - Engineering & Manufacturing Development (TIARA)	0604766A	876
Tactical Surveillance System - Engineering Development	0604740A	842
Tactical Unmanned Ground Vehicle	0604641A	739
Target Systems Development	0604258A	1089
Technical Information Activities	0605803A	1203
Terrain Information - Engineering Development (TIARA)	0604716A	830
Threat Simulator Development	0604256A	1086
University and Industry Research Centers	0601104A	76
Weapons and Munitions - Advanced Development	0603802A	580



## ALPHABETICAL LISTING

### Program Element Title

	PE	PAGE
Weapons and Munitions - Engineering Development	0604802A	923
Weapons and Munitions Advanced Technology	0603004A	346
Weapons and Munitions Technology	0602624A	173

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601101A In-House Laboratory Independent

Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	13657	14393	15113	15828	16623	17452	17821	18231	Continuing	Continuing
A91A In-House Laboratory Independent Research - Army Materiel Command	9081	9686	10354	10877	11440	12071	12330	12617	Continuing	Continuing
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3721	3828	3968	4126	4321	4488	4581	4687	Continuing	Continuing
A91D In-House Laboratory Independent Research - Corps of Engineers	733	752	791	825	862	893	910	927	Continuing	Continuing
A91E In-House Lab Independent Research - Army Res Inst of Behavioral and Social Sciences	122	127	0	0	0	0	0	0	0	249

**Mission Description and Budget Item Justification:** In-House Laboratory Independent Research (ILIR) provides a source of competitive funds to technical directors to stimulate high quality, innovative research with significant opportunity for payoff in Army warfighting capability. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and nurturing senior researchers as well as the most promising, developing scientists. The ILIR funding allocation is based on the quality of past performance. Each year, ILIR project reports are submitted from competing Army research organizations to the Office of the Assistant Secretary of Army (Research, Development, and Acquisition). These ILIR reports are subjected to a strenuous technical peer review by a review committee composed of leading scientists and engineers from the National Academy of Sciences, the Army Science Board, and Army Secretariat. ILIR funding allocation for the subsequent year is based on the score assessed by the ILIR review committee. Successful ILIR projects are typically transitioned to start-up projects under 6.1 or 6.2 mission funding within the organization. For example, ILIR research at the Missile Command Research, Development, and Engineering Center (MRDEC) led to the development of a hydrogen/hydrocarbon gas generator for air-breathing propulsion systems. This effort was integrated into the MRDEC 6.2 core propulsion program. Armament Research, Development and Engineering Center (ARDEC) ILIR research investigated dynamic effects on gun tubes and determined methods for controlled tank cannon gun tube vibrations. This effort transitioned to a 6.2 Smart Barrel Actuator program for tank main guns. ILIR research on a low heat rejection engine at the Tank-Automotive Research, Development and Engineering Center (TARDEC) played a major role in engine improvements that were implemented in both M109 Howitzer and Paladin upgrades, approximately 700 total Army vehicles. Other potential spin-offs from this TARDEC ILIR program to tactical trucks and tracked combat vehicles have been considered. Since its establishment by DoD Directive number 3201.4, dated October 8, 1993, the Army's ILIR program has supported and will continue to promote the 1987 Defense Science Board Study on Technology Base Management's recommendation to attract and retain top light science and engineering PhDs. The projects in this PE explore fundamental concepts in science and technology and therefore are correctly placed in Budget Activity 1.

Page 1 of 9 Pages

Exhibit R-2 (PE 0601101A)

1

Item 1

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601101A In-House Laboratory Independent Research								A91A	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91A	In-House Laboratory Independent Research - Army Materiel Command	9081	9686	10354	10677	11440	12071	12330	12617	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides funding for ILIR research which is allocated among the seven Research, Development and Engineering Centers (RDECs) in the Army Materiel Command (AMC).</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>9081 - Missile RDEC - Improved fast learning neural networks for system control; continued development of photonic band edge technology; developed methodology for characterization of gel propellants; developed algorithms for prediction of helicopter signatures and missile detection.</li> <li>-Armaments RDEC - Evaluated unique phenomena in energetic materials, barrel coatings to reduce barrel wear, dynamic modeling for weapons design and materials for passive shielding from low frequency magnetic fields; continued research in weaponry-unique robotics, voice control and software architecture; supported research in superconductivity and hypervelocity physics.</li> <li>-Tank-Automotive RDEC - Developed nonlinear models of compliant structures, heat transfer mechanisms for cold start engine phenomena, and non-invasive thermal imaging of engine combustion phenomena.</li> <li>-Natick RDEC - Applied fractal analyses to biodegradable materials; examined selected metallic macrocycles for non-linear optical and excited state properties.</li> <li>-Edgewood RDEC - Linked virus simulants with detector molecules (fluorochromes, etc.) and began screening for reactivity; defined most promising theory for correlation of adsorption equilibria with adsorbent properties; used molecular modeling to determine the optimum substrate configuration of dipeptides for improving the performance of nerve agent degrading enzymes; prepared bidentate sulfur containing ligands for ruthenium as candidate dopants for a surface to be used for a light-induced catalytic agent destruction.</li> <li>-Aviation RDEC - Tested and measured aircraft in-flight characteristics; transitioned neural network based helicopter simulator software to support the Free Flight Rotorcraft Research Project and the Autonomous Scout Rotorcraft Testbed technology demonstration program.</li> <li>-Communications-Electronics RDEC - Transitioned antenna programs to core tech base; developed models to enhance imaging sensors capabilities; developed more efficient algorithms for Intelligence and Electronic Warfare data fusion; upgraded sensor simulation/performance models.</li> </ul> <p>Total 9081</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>9547 - Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities.</li> </ul> <p>Project A91A</p>											

Exhibit R-2 (PE 0601101A)

Page 2 of 9 Pages

2

Item 1

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601101A In-House Laboratory Independent

Research

PROJECT

A91A

## FY 1997 Planned Program: (continued)

- Armaments RDEC -Evaluate unique phenomena in weapons and munitions related research, focusing on gun/cannon barrel erosion prevention and energetic materials for various weaponry applications.
  - Tank-Automotive RDEC -Develop an improved understanding of advanced diesel engine technology through nonlinear models of compliant structures, heat transfer mechanisms for cold start engine phenomena, and non-invasive thermal imaging of engine combustion phenomena.
  - Natick RDEC -Identify innovative technologies in the areas of molecular biology, biopolymers and modeling of personnel equipment characteristics.
  - Edgewood RDEC -Investigate innovative approaches to pathogen detection including development of DNA super libraries and genome sequencing of pathogens; begin development of respirator encumbrance model for the individual soldier.
  - Aviation RDEC -Demonstrate a new rapid, non-intrusive velocity measurement technique, Doppler Global Velocimetry, for measuring rotorcraft 3D flow fields.
  - Communications-Electronics RDEC -Develop antenna and sensor technologies and computer models; improve intelligence data fusion techniques; upgrade sensor simulation/performance models.
  - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- 139
- Total 9686

## FY 1998 Planned Program:

- 10354 - Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts.
  - Armaments RDEC -Investigate processes for real-time material characterization, advanced energetic materials development, and controlled biodegradation of battlefield explosives.
  - Tank-Automotive RDEC -Use fractals to analyze visual signatures; optimize laser-induced breakdown directed energy protection devices; implement singular perturbed non-linear track model on a supercomputer; investigate non-linear controllers for active suspension systems.
  - Natick RDEC -Use innovative modeling tools for characterizing materials/fabrics/food constituents for application to military clothing and ration systems with the goal of improving soldier protection and performance.
  - Edgewood RDEC -Complete investigation of innovative approaches to biodetection via DNA super libraries and genome sequencing of biological agents; transition investigation to core program. Complete development of respirator encumbrance model and transition to exploratory development.
  - Aviation RDEC -Develop and demonstrate techniques for active control of rotor blades for high-lift and/or for reduced vibration.
  - Communications-Electronics RDEC -Transition intelligence data fusion techniques to core technology base; improve battlefield visualization software tools; develop antenna and sensor technologies and virtual prototyping models; upgrade sensor simulation performance models; explore advanced battery technology.
- Total 10354

Project A91A

Page 3 of 9 Pages

Exhibit R-2 (PE 0601101A)

3

Item 1

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
1 - Basic Research	0601101A In-House Laboratory Independent Research	A91A	
<b>FY 1999 Planned Program:</b> <ul style="list-style-type: none"> <li>10877 - Missile RDEC - Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts.</li> <li>Armaments RDEC - Evaluate micro-electro mechanical systems (MEMS) technology for low-cost projectile guidance and control; continue investigations into real-time material characterizations and advanced energetic materials.</li> <li>Tank-Automotive RDEC - Correlate ignition delays with combustion temperature and pressure profiles; automate multibody dynamic systems modeling using algebraic constraints; calculate 3-D stress distributions in thick composite materials.</li> <li>Natick RDEC - Validate models of materials/fabric/food constituents against known parameters, transfer results to core basic research and applied research programs in ration and clothing research.</li> <li>Edgewood RDEC - Initiate project to prove concept for a specific virus detector. Begin construction of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor.</li> <li>Aviation RDEC - Investigate application of "smart materials" and/or micro-electro mechanical systems (MEMS) for alleviation of dynamic stall to improve rotor aerodynamics.</li> <li>Communications-Electronics RDEC - Upgrade battlefield visualization tools; transition antenna technologies; improve power sources technology, advance sensor technology base.</li> </ul>			
Total	10877		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	9255	9893	10803
Adjustments to Appropriated Value	9513	9686	11727
FY 1998 Pres Bud Request	-432		
	9081	9686	10354
			10877

Project A91A

Page 4 of 9 Pages

Exhibit R-2 (PE 0601101A)

4

Item 1

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601101A In-House Laboratory Independent Research

PROJECT

A91C

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3721	3828	3968	4126	4321	4488	4581	4687	Continuing	Continuing

**A. Mission Description and Justification:** Represents funds to conduct ILIR research allocated among the six laboratories of the Medical Research and Materiel Command, including the Aeromedical Research Laboratory, the Institute of Surgical Research, the Institute of Environmental Medicine, the Medical Institute of Chemical Defense, the Medical Institute of Infectious Diseases and Walter Reed Army Institute of Research.

## FY 1996 Accomplishments:

- 3721 - Conducted research in medical countermeasures against naturally occurring infectious diseases which may have significant impacts on military operations to protect the force from infection and sustain operations.
- Conducted research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.
- Conducted research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.

Total 3721

## FY 1997 Planned Program:

- 3735 - Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations.
- Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.
- Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.
- 93 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3828

## FY 1998 Planned Program:

- 3968 - Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations.

Project A91C

Page 5 of 9 Pages

Exhibit R-2 (PE 0601101A)

5

Item 1

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT																				
1 - Basic Research		0601101A In-House Laboratory Independent Research	A91C																				
<p><b>FY 1998 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.</li> <li>- Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.</li> </ul> <p>Total 3968</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4126 - Continue research for medical countermeasures against naturally occurring infectious diseases which can have significant impacts on military operations to protect the force from infection and sustain operations.</li> <li>- Continue research in medical defense against environmental extremes and operational hazards to health focusing on physiological and psychological factors limiting soldier effectiveness.</li> <li>- Continue research in medical defense against aggressor weapons systems by understanding the basic mechanisms of combat related trauma, identifying innovative treatment and surgical procedures to extend the "golden hour" following trauma.</li> </ul> <p>Total 4126</p> <p><b>B. Project Change Summary</b></p> <p>FY1997 President's Budget Appropriated Value Adjustments to Appropriated Value FY1998 Pres Bud Request</p> <table> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>3817</td> <td>3910</td> <td>4269</td> <td>4369</td> </tr> <tr> <td>3924</td> <td>3828</td> <td></td> <td></td> </tr> <tr> <td>-203</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3721</td> <td>3828</td> <td>3968</td> <td>4126</td> </tr> </tbody> </table>				FY 1996	FY 1997	FY 1998	FY 1999	3817	3910	4269	4369	3924	3828			-203				3721	3828	3968	4126
FY 1996	FY 1997	FY 1998	FY 1999																				
3817	3910	4269	4369																				
3924	3828																						
-203																							
3721	3828	3968	4126																				
Project A91C		Page 6 of 9 Pages																					
		Exhibit R-2 (PE 0601101A)																					
		Item 1																					

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601101A In-House Laboratory Independent Research

PROJECT

A91D

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91D In-House Laboratory Independent Research - Corps of Engineers	733	752	791	825	862	893	910	927	Continuing	Continuing

**A. Mission Description and Justification:** Represents funds to conduct ILIR research allocated among the four laboratories within the Army Corps of Engineers, including the Topographic Engineering Center, the Waterways Experimental Station, the Construction Engineering Research Laboratories and the Cold Regions Research and Engineering Laboratory.

**FY 1996 Accomplishments:**

- 733 - Conducted studies in dynamic terrain representation for simulation and computerized terrain data analysis techniques at the Topographic Engineering Center.
- Developed chemical oxidation techniques for explosive contamination on oversized solids; enhanced technology for identification and quantification of lighter petroleum fraction compounds at the Waterways Experimental Station.
- Performed mathematical modeling, lab testing and computer simulation of electromagnetic phenomena in inverter-fed AC rotating machines at the Construction Engineering Research Laboratories.
- Examined the fundamental diffusion processes of organic compounds in snow and explore the relationship between snow metamorphosis and avalanche release mechanisms at the Cold Regions Research and Engineering Laboratory.

Total 733

**FY 1997 Planned Program:**

- 734 - Continue research in the terrain representation process and terrain data generation by sponsoring related topics in these areas at the Topographic Engineering Center.
- Determine in vitro molecular and cellular toxicity of TNT, RDX, and HMX explosives to establish biomarkers of exposure at the Waterways Experimental Station.
- Develop simplified, parameter-insensitive, sensorless machine control techniques at the Construction Engineering Research Laboratories.
- Explore physics based correlations between mechanical and electrical properties of sea ice as a basis for translation of satellite sensor data to physical behavior and examine means to characterize the diffusion of various chemical species through frozen soils and permafrost at the Cold Region Research and Engineering Laboratory.
- 18 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 752

Project A91D

Page 7 of 9 Pages

Exhibit R-2 (PE 0601101A)

7

Item 1

UNCLASSIFIED



## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT																				
1 - Basic Research		0601101A In-House Laboratory Independent Research	A91D																				
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>791 - Devise automated classification and feature extraction algorithms for Georegistered Interferometric Synthetic Aperture Radar and Hyperspectral Imagery.</li> <li>- Develop a simulation model and laboratory performance test for evaluation of fundamental machines.</li> <li>- Develop interference pattern approach for subsurface object detection in snow/frozen ground.</li> <li>- Determine hydrodynamic interaction of sediment mitigation and in-situ object transport in harbors, rivers and areas in proximity to Logistics Over The Shore operations.</li> </ul> <p>Total 791</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>825 - Exploit image statistics from multi-scale transforms for extraction of topographic information from imagery.</li> <li>- Demonstrate the feasibility of shaft sensorless control systems capable of determining the vibration characteristics of rotating machine technology.</li> <li>- Develop hyperspectral approach for snow cover property assessment.</li> <li>- Develop transport mechanisms (including chemical interactions) of contaminants through porous media at micropore scale.</li> </ul> <p>Total 825</p> <p><b>B. Project Change Summary</b></p> <p>FY1997 President's Budget Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY1998 Pres Bud Request</p> <table border="1"> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>753</td> <td>768</td> <td>840</td> <td>860</td> </tr> <tr> <td>773</td> <td>752</td> <td></td> <td></td> </tr> <tr> <td>-40</td> <td></td> <td></td> <td></td> </tr> <tr> <td>733</td> <td>752</td> <td>791</td> <td>825</td> </tr> </tbody> </table>				FY 1996	FY 1997	FY 1998	FY 1999	753	768	840	860	773	752			-40				733	752	791	825
FY 1996	FY 1997	FY 1998	FY 1999																				
753	768	840	860																				
773	752																						
-40																							
733	752	791	825																				

Project A91D

Page 8 of 9 Pages

Exhibit R-2 (PE 0601101A)

8

Item 1

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601101A In-House Laboratory Independent Research

PROJECT

A91E

COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A91E	In-House Lab Independent Research - Army Res Inst of Behavioral and Social Sciences	122	127	0	0	0	0	0	0	0	249

**A. Mission Description and Justification:** Represents funds allocated to the Army Research Institute for Behavioral and Social Sciences to conduct ILIR research.

**FY 1996 Accomplishments:**

- 122 - Investigated the role of distance estimation and configuration learning in virtual environments.
- Total 122

**FY 1997 Planned Program:**

- 124 - Conduct research on the transfer of training from virtual to real environments.
- 3 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 127

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY1997 President's Budget	125	130	143	147
Appropriated Value	130	127		
Adjustments to Appropriated Value	-8			
FY1998 Pres Bud Request	122	127	0	0

Change Summary Explanation: Due to program restructuring, the ILIR program is no longer funded for ARI beyond FY1997.

Project A91E

Page 9 of 9 Pages

Exhibit R-2 (PE 0601101A)

9

Item 1

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

## 0601102A Defense Research Sciences

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	121822	119739	138165	141555	142369	144927	146800	150031	Continuing	Continuing
AF20 Advanced Propulsion Research	2118	2284	2414	2512	2630	2733	2790	2871	Continuing	Continuing
AF22 Research in Vehicular Mobility	473	438	542	567	591	610	621	632	Continuing	Continuing
AH42 Materials and Mechanics	1548	1738	1921	2000	2094	2176	2222	2269	Continuing	Continuing
AH43 Research in Ballistics	4853	5466	5827	6059	6345	6594	6735	6952	Continuing	Continuing
AH44 Advanced Sensors Research	1685	3284	4902	5047	3750	3896	3978	4105	Continuing	Continuing
AH45 Air Mobility	1829	1809	2191	2280	2385	2477	2528	2584	Continuing	Continuing
AH47 Applied Physics Research	2613	2751	3083	3207	3359	3489	3564	3688	Continuing	Continuing
AH48 Battlespace Information & Communications Res	0	6729	6199	7925	6988	6417	8617	8110	Continuing	Continuing
AH52 Equipment for the Soldier	941	831	1014	1056	1105	1145	1167	1192	Continuing	Continuing
BH57 Scientific Problems with Military Applications	53307	46812	58174	56475	56343	57313	56697	58230	Continuing	Continuing
AH66 Advanced Structures Research	1257	1287	1405	1465	1532	1590	1622	1669	Continuing	Continuing
BH67 Environmental Research - Army Material Cmd	3811	4798	5709	4917	5575	5598	4603	4795	Continuing	Continuing
AH68 Processes in Pollution Abatement Technology	419	343	427	447	465	283	291	300	Continuing	Continuing
BS04 Military Pollutants and Health Hazards	649	585	718	750	782	516	531	546	Continuing	Continuing
BS13 Science Base/Medical Research Infectious Disease	8964	8253	10209	11357	11763	12169	12883	13145	Continuing	Continuing

Page 1 of 66 Pages

Exhibit R-2 (PE 0601102A)

10

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

## 0601102A Defense Research Sciences

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS14	Science Base/Combat Casualty Care Research	4071	3749	4523	4702	4925	5118	5224	5346	Continuing	Continuing
BS15	Science Base/Army Operational Medicine Research	6654	5543	6094	6863	7139	7418	7574	7752	Continuing	Continuing
BS16	Science Base/Combat Dentistry Research	464	459	0	0	0	0	0	0	0	923
BS17	Molecular Biology/Military HIV Research	877	783	499	482	552	592	612	635	Continuing	Continuing
BS18	Marine Derived Biocatalysts	0	636	0	0	0	0	0	0	0	636
AT22	Soil and Rock Mechanics	1897	1730	2095	2180	2281	2369	2416	2470	Continuing	Continuing
AT23	Basic Research/Military Construction	1788	1500	1818	1892	1979	2054	2095	2143	Continuing	Continuing
AT24	Snow, Ice and frozen Soil	1210	1104	1343	1399	1462	1517	1547	1581	Continuing	Continuing
BT25	Environmental Research - Corps of Engineers	4725	3070	3608	4001	3749	3757	3091	3214	Continuing	Continuing
A305	Automatic Target Recognition Research	1034	1132	1186	1237	1292	1340	1368	1409	Continuing	Continuing
A31B	Infrared Optics Research	2075	2233	2330	2425	2538	2637	2693	2771	Continuing	Continuing
B52C	Mapping and Remote Sensing	2408	2196	2655	2763	2892	3003	3066	3137	Continuing	Continuing
B53A	Battlefield Environment and Signature	5407	3530	3672	3822	4003	4160	4249	4378	Continuing	Continuing
B74A	Human Engineering	2110	2255	2620	2728	2856	2966	3029	3121	Continuing	Continuing
B74F	Personnel Performance and Training	2635	2411	987	997	994	990	987	986	Continuing	Continuing

Exhibit R-2 (PE 0601102A)

Page 2 of 66 Pages

11

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

**Mission Description and Budget Item Justification:** This program element is focused on sustaining the Army's technological superiority for effectiveness in land warfighting capability and the Army Vision for Force XXI. The program focuses in-house laboratory research on Army unique expertise and capabilities, capitalizing on the scientific talent and specialized facilities to expeditiously transition the resulting knowledge and technology into the appropriate developmental activities. The extramural program leverages the research efforts of other government agencies, academia, and industry for those areas where the Army does not have the technical lead. This translates to a coherent, well-integrated program which is executed by the following six primary contributors: 1) the Army Research Laboratory (ARL); 2) the seven Army Materiel Command Research, Development and Engineering Centers (RDECs); 3) the four Army Corps of Engineer laboratories; 4) the six Army Medical Research and Materiel Command laboratories; 5) the Army Research Institute; and 6) the Army Research Office (ARO). The Army's research program promotes quality through activities such as in-depth reviews of the entire basic research program at all levels and the development of strategic research objectives. The Army broadened its research base by expanding basic research investment in Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) to 5% of its individual investigator program. This core research program is complemented by the inter-disciplinary research performed under the University Research Initiative (URI) program. The basic research program is coordinated with the other Services via the Joint Directors of Laboratories panels, Project Reliance, and other interservice working groups. The work in this program element is consistent with rigorous peer review, the Army Science and Technology Master Plan (ASTMP), Science and Technology Objectives (STOs) milestones for the Army's key emerging technologies, and the Army Modernization Plan. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1. The resultant science base provides the source for follow-on applied research (6.2) and, eventually, advanced technology development (6.3) programs.

Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University/Industry Research Centers), PE 0602120A (Electronic Survivability and Fuzing Technology), PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology), PE 0602720A (Environmental Quality Technology) (DA Proj 835 only), PE 0602784A (Military Engineering Technology), PE 0602786A (Logistics Technology), PE 0602787A (Medical Technology), PE 0603105A (Medical Human Immunodeficiency Virus (HIV) Research), PE 0603002A (Medical Advanced Technology), PE 0603807A (Medical Systems-Advanced Development), PE 0604807A (Medical Materiel/Medical Defense Equipment-Engineering Development), PE 0605801A (Program wide Activities, Project MMO2), PE 0605898A (Management Headquarters R & D, Project MMO3), and PE 0601103D (University Research Initiatives); the Navy, Air Force, and other Department of Defense agencies; National Aeronautics and Space Administration; National Science Foundation; Department of the Interior; Department of Energy; National Bureau of Standards; other government agencies; and government agencies of Allied nations sponsor related research in areas of this program.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AF20

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF20 Advanced Propulsion Research	2118	2284	2414	2512	2630	2733	2790	2871	Continuing	Continuing

**A. Mission Description and Justification:** This project is unique in the Army and DoD, as it is the only basic research project focused on turboshaft engine-specific technology and mechanical power transmission technology. The Army is the lead service in these technology areas under Project Reliance. The purpose of this project is to perform basic research in propulsion, as applicable to rotorcraft and tracked and wheeled vehicles. Analysis, code development, experiments and evaluations are conducted to improve engine and drive train components and investigate advanced materials. Component level investigations include compressors, combustors, turbines, injectors, pistons, cylinder liners, piston rings, gears, seals, bearings, shafts, and controls. The goal of the activity is increased performance of small airbreathing engines and power trains, to support improvements in system mobility, reliability and survivability.

**FY 1996 Accomplishments:**

- 2118 - Completed investigation of the effects of shrouded stator seal cavities on compressor and stator performance for several stator cavity leakage rates.
- Completed "reduced chemistry" model for advanced combustor code.
- Completed model of crack propagation in thin rim gears. Completed low noise gearbox validation experiments.
- Completed analysis of a powder lubricated composite slider bearing using the continuum model approach.
- Investigated high temperature fatigue life model, and completed ceramic matrix composite oxidation protection studies. Investigated characterization of high-temperature polymer mechanical properties retention.
- Included deformation effects in journal bearing code.

Total

2118

**FY 1997 Planned Program:**

- 2284 - Complete diffuser flow field tests for large, low-speed centrifugal compressor.
- Complete carbon deposits/radiation modeling for advanced combustor code; release code (ALLSPD-3D, version 2.0) to industry.
- Develop analytical tools for low noise face gears. Develop concepts for non-ferrous gears. Validate performance of thin-rimmed, high-speed gears.
- Complete solid lubrication model development.
- Characterize advanced ceramic matrix composite oxidation-resistant coatings.
- Test experimental oxidation-resistant coatings for high-temperature polymers.
- Complete linear stability analysis for finite (with end effects) journal bearing.

Total

2284

Project AF20

Page 4 of 66 Pages

Exhibit R-2 (PE 0601102A)

13

Item 2

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 1 - Basic Research

0601102A Defense Research Sciences

AF20

## FY 1998 Planned Program:

- 2414 - Complete investigation of impeller/diffuser interaction for large, low-speed centrifugal compressor.
- Complete version 1.0 (unstructured grid version) of National Combustor Code and release to U.S. Industry.
- Obtain fundamental heat transfer data for developing/validating "wall function" models for 3D Navier Stokes internal/external cooling flow calculations.
- Complete 3D crack prediction code for spiral bevel gears.
- Complete characterization of oxidation resistant coatings for advanced ceramic matrix composites.
- Develop high temperature, stable graphite/polyimide sheet molding compound (SMC) for engine component applications.
- Complete characterization of advanced ceramic coating materials for low heat rejection diesel engine application.

Total 2414

## FY 1999 Planned Program:

- 2512 - Characterize inlet distortion effects on impeller performance for large, low-speed centrifugal compressor.
- Demonstrate quick execution (overnight turnaround) for version 2.0 of the National Combustor Code.
- Characterize the coupling between internal convection and external film cooling for turbines.
- Complete high speed gearing thermal behavior code.
- Conduct preliminary screening of candidate materials for very high temp. (>3000 degrees F) applications.
- Develop short term (<1 week) thermal characterization methodology for correlating actual long term (life time) thermo-oxidative stability of polymer composites.
- Define complete advanced coating system for low heat rejection diesel engine application (multiple layer processing, structural analyses, and characterization).

Total 2512

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	2176	2365	2408	2448
Appropriated Value	2236	2284		
Adjustments to Appropriated Value	-118			
FY 1998 Pres Bud Request	2118	2284	2414	2512

Project AF20

Page 5 of 66 Pages

Exhibit R-2 (PE 0601102A)

14

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AF22

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF22 Research in Vehicular Mobility	473	438	542	567	591	610	621	632	Continuing	Continuing

**A. Mission Description and Justification:** This project conducts research in support of advanced military engine technology with emphasis on advanced propulsion, sophisticated vehicle dynamics and simulation, and advanced track and suspension concepts. Advanced propulsion research will dramatically improve power density, performance and thermal efficiency for advanced adiabatic diesel engines, transient heat transfer, high temperature materials and thermodynamics. This project also supports state-of-the-art simulation technologies to achieve a more fundamental understanding of advanced high-output military engines. The subject research is directed at unique, state-of-the-art phenomena in the specific areas of: 1) non-linear ground vehicle control algorithms, using off-road terrain characteristics; and 2) instantaneous diesel engine low friction/cold start optimizations, using advanced analytical and experimental procedures. The subject efforts offer an opportunity to produce quantum Army ground vehicle performance enhancements through the use of optimized parameterization procedures.

**FY 1996 Accomplishments:**

- 473 - Conducted research to optimize symbolic numerical algorithms which permit accurate, real-time, and cost effective dynamic vehicle simulation.
- Refined vehicle/human interface theory to allow accurate predictability of phenomena.
- Developed vehicle dynamic theory permitting real-time simulation of active control characteristics.
- Developed fundamental simulative models for advanced ground vehicle powertrain components.

Total 473

**FY 1997 Planned Program:**

- 431 - Validate symbolic numerical algorithms within real-time vehicle dynamic scenarios.
- Enhance numerical computational efficiencies of simulative models describing vehicle/human interfaces.
- Demonstrate control algorithms for autonomous neural networks in support of vehicle accident avoidance.
- Optimize and validate fundamental simulative models for unique ground vehicle powertrain component combinations.
- 7 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 438

**FY 1998 Planned Program:**

- 542 - Formulate state-of-the-art non-linear vehicle dynamics insights.
- Establish vehicle/human control algorithms for military systems performance enhancements.
- Validate fundamental powertrain component models for unique ground vehicles.

Total 542

Project AF22

Page 6 of 66 Pages

Exhibit R-2 (PE 0601102A)

15

Item 2

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																												
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>AF22</b>																											
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>567 - Validate state-of-the-art vehicle dynamics phenomena.</li> <li>- Optimize vehicle/human control models for off-road scenarios.</li> <li>- Optimize fundamental powertrain characteristic phenomena using advanced simulation procedures.</li> </ul> <p>Total 567</p>																													
<p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>484</td> <td>521</td> <td>542</td> <td>567</td> </tr> <tr> <td>Appropriated Value</td> <td>498</td> <td>438</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-25</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>473</td> <td>438</td> <td>542</td> <td>567</td> </tr> </tbody> </table>						FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	484	521	542	567	Appropriated Value	498	438			Adjustments to Appropriated Value	-25				FY 1998 Pres Bud Request	473	438	542	567
	FY 1996	FY 1997	FY 1998	FY 1999																									
FY 1997 President's Budget	484	521	542	567																									
Appropriated Value	498	438																											
Adjustments to Appropriated Value	-25																												
FY 1998 Pres Bud Request	473	438	542	567																									

Project AF22

Page 7 of 66 Pages

Exhibit R-2 (PE 0601102A)

16

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

1 - Basic Research

AH42

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH42 Materials and Mechanics	1548	1738	1921	2000	2094	2176	2222	2269	Continuing	Continuing

**A. Mission Description and Justification:** This project establishes the science base for creating and producing advanced materials to achieve higher performance, lower cost, improved reliability, and environmental compatibility for Army unique system and component applications. Emphasis is on: synthesis, processing and understanding fundamental aspects of chemistry and microstructure that influence the performance and failure mechanisms of materials subjected to high impact and strain rates (armor/armaments); the barrier properties and performance characteristics of materials subjected to chemical, biological and directed energy threats; and the durability, service life and maintenance of candidate materials for soldier systems, personnel support, armor, armaments, aircraft, ground and combat vehicles, and combat support.

**FY 1996 Accomplishments:**

- 1548 -Synthesized and characterized bulk ferroelectric composites for phased array antenna applications.
- Determined shock induced damage in armor materials under oblique impact/shock.
- Correlated hydrogen bonding energies with microstructural constituents in high strength steels intended for aviation and armor use.
- Converted an elastic higher-order thick beam theory developed by NASA into a highly viscous quasi-static higher-order thick beam theory; completed finite element analysis of composite armored vehicle-like thick curved composite laminates to determine strain energy release rates.

Total

1548

**FY 1997 Planned Program:**

- 1738 -Establish the science base for creating and producing special function electrical, magnetic, optical, chemical-biological protective, and smart-responsive materials.
- Provide an enhanced knowledge base of the relationship between microstructure and mechanisms of flow and failure in materials subjected to high strain rates typical of armor/anti-armor events.
- Provide an enhanced knowledge base to relate the structure and properties of metal, ceramic, polymer, composite and hybrid materials surfaces and interphases to improve performance and long-term durability.
- Include dynamics in the viscous quasi-static higher-order thick beam theory, and initiate installation of theory in NASA's COMET Finite Element code; conduct parametric studies and tests to understand influence of lay-up and geometry on strength and failure of thick curved composite laminates.

Total

1738

Project AH42

Page 8 of 66 Pages

Exhibit R-2 (PE 0601102A)

17

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH42

## FY 1998 Planned Program:

- 800 -Explore novel processing techniques for low cost production of smart composite materials.
- Develop novel high performance whiskerized functional graded aluminum metal matrix composite (MMC) armor material.
- Scale-up the metal oxide deposition (MOD) process for large area and thicker films and investigate the application of metal oxide chemical vapor deposition (MOCVD) process for deposition of thin films.
- 500 -Design improved primers by generalizing molecular models to predict effects of contaminants and environments on bonding.
- Investigate processing behavior and characterize microstructure-properties of novel biomimetic ceramic materials.
- Investigate various ion beam hydrogen depth profiling techniques for measuring constituents which affect reliability/ballistic performance for armor alloys.
- 445 -Extend constitutive models to predict impact damage in 3-D polymer matrix composites.
- Investigate relationship of fiber-matrix interface strength for selection of composites with reduced momentum transfer.
- 176 -Include thermal effects in the new constitutive models for both elastomers and composites; develop and validate failure criteria for thick curved composite laminates.

Total 1921

## FY 1999 Planned Program:

- 819 -Develop constitutive models describing mesoscale, smart sensors/actuators in multi-functional composites.
- Investigate fundamentals of processing and microstructure-properties studies of biomimetic materials.
- Investigate processing and microstructure-property behavior of novel functional graded aluminum MMC materials.
- 500 -Develop and verify models for diffusion-enhanced bonding of integrated composite systems.
- Demonstrate/evaluate high throwing power plasma deposited coatings.
- 500 -Conduct fundamental studies to understand material response under extreme ballistic environment.
- Extend constitutive models to predict impact damage in thick-section, integrated composite materials.
- 181 -Investigate computational difficulties associated with simulating manufacturing of composite structures made with elastomers; initiate failure analysis of embedded armor composite hybrid structures.

Total 2000

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
1553	1879	2005	2167
1597	1738		
-49			
1548	1738	1921	2000

Project AH42

Page 9 of 66 Pages

Exhibit R-2 (PE 0601102A)

18

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

AH43

## 1 - Basic Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH43 Research in Ballistics	4853	5466	5827	6059	6345	6594	6735	6952	Continuing	Continuing

**A. Mission Description and Justification:** This project establishes the science base for developing the fundamental understanding of ballistic phenomena unique to Army and DoD weapons systems. A multidisciplinary approach is taken with an emphasis on combustion chemistry, physics and fluid dynamics, physics of explosive materiel, interior ballistic reaction kinetics, and terminal ballistic phenomena. The research accomplished under this project will lead to ballistics technologies that will enhance the lethality and survivability of Army and DoD combat systems.

## FY 1996 Accomplishments:

- 4853 -Formulated liquid propellant jet breakup and combustion algorithms applicable to the high pressure regime in guns.
- -Conducted interior ballistic simulations of a granular solid propellant at high initial loading density and subjected to external (e.g., plasma) energy addition; assessed its combustion stability.
- Extended current models of non-steady rod penetration to include length/diameter (L/D) effects and demonstrated utility by comparing with penetration over a range of L/D values.
- Incorporated infrared tracker technologies in real-time range demonstration of counter-kinetic energy components.
- Investigated collateral effects of electromagnetic (EM) environments from pulsed power sources and electromagnetic (EM) guns and systems on host vehicles, personnel and on other nearby assets.

Total

4853

## FY 1997 Planned Program:

- 5387 -Develop submodels of the surface and subsurface physics and chemistry of nitramine composite propellants which account for oxidizer particle-size dependence on burning rate.
- Develop a finite element model capable of computing the transverse loads and accelerations imparted to sensitive projectile guidance and control components inside a gun tube.
- Develop a simple analytical model for ceramic armor elements, including the dwell phenomenon, using a minimum of model-based parameters.
- Exploit theoretical and experimental capabilities to develop EM armor scaling relationships.
- 79 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

5466

Project AH43

Page 10 of 66 Pages

Exhibit R-2 (PE 0601102A)

19

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																				
BUDGET ACTIVITY	PE NUMBER AND TITLE																						
1 - Basic Research	0601102A Defense Research Sciences	February 1997	AH43																				
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5827 -Initiate development of 2D and 3D computational tools for understanding the electrodynamic of moving conductors by treating the motion of liquids, plasmas, and material undergoing elastic-plastic deformation in electromagnetic fields.</li> <li>-Apply classical forcefields to predict known physical properties and initial reaction steps for nitramine propellant combustion.</li> <li>-Demonstrate test-bed for constitutive properties of composites in artillery/mortar applications.</li> <li>-Determine how the high shear rate mechanical properties of energetic materials affect their initiation behavior.</li> </ul> <p>Total 5827</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6059 -Conduct high speed, quantitative spectroscopy on munition impact flash and gun muzzle flash to reduce the technical barriers for applying emerging optical sensing technologies to the battlefield.</li> <li>-Explore the ignition and combustion characteristics of typical slurry propellant mixture proposed for high loading-density gun systems.</li> <li>-Develop coupled computational fluid dynamic/rigid body dynamic finite difference methodology to apply to the aerodynamic response of tube launched rockets and smart munitions shapes.</li> <li>-Develop a qualitative picture of ballistic failure processes based on the flow and failure of materials under conditions of ballistic impact.</li> </ul> <p>Total 6059</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget Appropriated Value Adjustments to Appropriated Value FY 1998 Pres Bud Request</p> <table> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>4921</td> <td>5738</td> <td>5860</td> <td>6006</td> </tr> <tr> <td>5059</td> <td>5466</td> <td></td> <td></td> </tr> <tr> <td>-206</td> <td></td> <td>5827</td> <td>6059</td> </tr> <tr> <td>4853</td> <td>5466</td> <td></td> <td></td> </tr> </tbody> </table>				FY 1996	FY 1997	FY 1998	FY 1999	4921	5738	5860	6006	5059	5466			-206		5827	6059	4853	5466		
FY 1996	FY 1997	FY 1998	FY 1999																				
4921	5738	5860	6006																				
5059	5466																						
-206		5827	6059																				
4853	5466																						

Project AH43

Page 11 of 66 Pages

Exhibit R-2 (PE 0601102A)

20

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

		DATE		February 1997		PROJECT		AH44			
BUDGET ACTIVITY		PE NUMBER AND TITLE		0601102A Defense Research Sciences							
1 - Basic Research											
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH44	Advanced Sensors Research	1685	3284	4902	5047	3750	3896	3978	4105	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project exploits new opportunities in the basic sciences underpinning the technology areas of digital and image processing modules and algorithms, optical control of radar sensors, nonlinear optical materials and devices, remote sensing, and intelligent system distributive interactive simulations. Research involves fundamental science and engineering principles that support survivable sensor systems. Monolithic and hybrid optoelectronic structures in gallium arsenide and lithium niobate are investigated as integrated processors for novel signal and radar processing and control. Diffractive and micro-optic elements are developed to enhance performance of imagers and optical processors. For laser protection, nonlinear optical effects are being explored which will allow broad band protection. These nonlinear effects can also be used for optical image processing or holographic displays and storage. For remote sensing applications, research in materials is conducted that will allow direct lasing in the ultraviolet (UV) wavelength region.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1685 -Designed, constructed and characterized optical processors for image and signal processing, incorporating refractive, diffractive and/or integrated optical elements.</li> <li>-Continued research on components for optical control of microwaves by combining integrated optic beam splitter with phase modulators and amplifier structures.</li> <li>-Developed, tested and characterized wideband high-resolution, direction-finding, acoustic algorithms for tracking vehicles; researched projectile shock wave characterization.</li> <li>-Investigated properties of SiC including electronic impurities for compensation of epitaxial layers, high resistivity substrate materials and PIN diode limiters as a basis for developing robust electronics.</li> <li>-Investigated the underlying physical principles for better hybridization as well as different material issues and polarization issues for designing single polarization lasers.</li> </ul> <p>Total 1685</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1778 -Incorporate on-chip processing and optical pre-processing on two-dimensional photodetector arrays for improved performance and functionality.</li> <li>-Design photonic-based integrated optic processor for optical control of microwaves and phased arrays.</li> <li>-Research photonic implementations of automatic target recognition (ATR) and other signal processing algorithms.</li> <li>-Characterize beam fanning limiter performance.</li> <li>-Evaluate UV acoustic-optical tunable filter (AOTF) for remote sensing applications.</li> </ul>											

Project AH44

Page 12 of 66 Pages

Exhibit R-2 (PE 0601102A)

21

Item 2

UNCLASSIFIED



## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>AH44</b>	
<b>FY 1997 Planned Program: (continued)</b>			
	<ul style="list-style-type: none"> <li>- Investigate different semiconductor structures and physical/material properties. Utilize this knowledge to design and demonstrate high density smart-pixels and other concepts and devices for 2D optical processing, image processing, and for aided target recognition.</li> <li>- Conduct research focused on new data/image compression techniques to offset the growing demands for additional bandwidth in the distributed interactive simulation (DIS) environment.</li> <li>- Investigate techniques to automatically establish seamless connections between physical models in constructive, virtual, and live simulation.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>		
• 1469			
37			
Total 3284			
<b>FY 1998 Planned Program:</b>			
• 526	<ul style="list-style-type: none"> <li>- Implement and analyze potential solutions designed in previous fiscal year, producing a partially "fuzzified" system prototype.</li> <li>- Include algorithms for structured data text and adapting object technology to standards-based electronic data interchange (edi) in multimedia exchange model.</li> </ul>		
• 1020	<ul style="list-style-type: none"> <li>- Develop computational algorithms and intelligent agents for function and process coordinated overlay of intelligence and logistics synthetic environments on the synthetic sand table environment.</li> </ul>		
• 1256	<ul style="list-style-type: none"> <li>- Develop infrastructure to support high level architecture in a synthetic, DIS environment.</li> <li>- Investigate digital - optical processing for correction of common aberrations.</li> <li>- Design sensor protection prototype.</li> </ul>		
• 600	<ul style="list-style-type: none"> <li>- Integrate active and passive optical components for free space and guided wave communications and sensor processing.</li> </ul>		
• 1500	<ul style="list-style-type: none"> <li>- Integrate novel passive optic elements and digitals processing for advanced visible and infrared imaging.</li> <li>- Conduct two data collections with the ARL boom synthetic aperture radar (SAR) in differing clutter environments. Co-locate a FLIR with the BoomSAR during at least one of the data collection efforts.</li> </ul>		
Total 4902			
<b>FY 1999 Planned Program:</b>			
• 562	<ul style="list-style-type: none"> <li>- Continue the application of fuzzy logic techniques on a much larger scale by extending the partial solution(s) developed previously to a complete solution, producing a fully functional system prototype.</li> <li>- Insert multimedia application-to-application knowledge exchange technology into an operational data exchange system and validate multimedia exchange model.</li> </ul>		
• 1044	<ul style="list-style-type: none"> <li>- Incorporate high fidelity physical vulnerability models into the synthetic environment for STOW 2000.</li> <li>- Develop mission planning and rehearsal capability for the virtual sand table at the entity level.</li> </ul>		

Project AH44

Page 13 of 66 Pages

Exhibit R-2 (PE 0601102A)

22

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH44

## FY 1999 Planned Program: (continued)

- 1098 - Integrate and demonstrate digital optical processing for correction of aberration and focus independent depth of field.
- Design and fabricate diffractive optical elements (DOEs) with sub-micron features.
- Demonstrate realistic motion 3D hologram.
- 843 - Demonstrate advanced sensor processing and communication using integrated optical components.
- 1500 - Develop techniques to exploit the unique response from metal and dielectric mines. Begin to incorporate discrimination techniques in previously developed ARL detection framework.

Total 5047

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	1696	3385	3465	3561
Adjustments to Appropriated Value	1742	3284		
FY 1998 Pres Bud Request	-57	3284	4902	5047
	1685			

Change Summary Explanation: Funding increases in FY 1998 and 1999 reflect decision to increase investment in basic research related to countermeasures.

Project AH44

Page 14 of 66 Pages

Exhibit R-2 (PE 0601102A)

23

Item 2

UNCLASSIFIED



## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

AH45

COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH45	Air Mobility	1829	1809	2191	2280	2385	2477	2528	2584	Continuing	Continuing

**A. Mission Description and Justification:** Basic research in aerodynamics and avionics as applied to rotary wing aircraft. Analysis, code development, and test and evaluation are conducted on rotor unique aerodynamics, dynamics, performance, and aircraft performance and acoustics. Efforts in avionics are focused on antenna modeling and advanced display concepts.

**FY 1996 Accomplishments:**

- 1829 - Tested and evaluated smart airfoils and stall-free model rotors.
- Investigated rotor active control techniques for acoustic propagation.
- Conducted interactional aero-vibration code validation focused studies.
- Extended antenna codes to handle multiple composite materials.

Total 1829

**FY 1997 Planned Program:**

- 1765 - Expand smart airfoil results to revolutionary envelope expansion for rotorcraft.
- Initiate the combination of aeroacoustic theory with interactional aero computational fluid dynamics (CFD) codes.
- 44 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1809

**FY 1998 Planned Program:**

- 2191 - Complete scale model wind tunnel testing with a pneumatically actuated, trailing edge flap for high lift.
- Develop and validate the HELIX-II-2, which includes accelerated vorticity embedding method to prevent numerical dissipation problems.
- Develop advanced concepts for aeroelastic couplings to enable damperless/bearingless rotor systems by eliminating the need for auxiliary lead lag dampers to control ground/air resonance.
- Develop a grid-adaptive, unstructured overset scheme for the OVERFLOW code to improve the resolution of the rotor wake system.
- Integrate a panel methodology into an integrated aeromechanics analysis to model aerodynamic influence of fuselage and wing/empennage.

Total 2191

Project AH45

Page 15 of 66 Pages

Exhibit R-2 (PE 0601102A)

24

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 1 - Basic Research

0601102A Defense Research Sciences

AH45

## FY 1999 Planned Program:

- 2280 - Develop integral structure/actuator concepts for application to practical multi-controller active, on-blade controlled rotor systems for low vibration rotorcraft.
- Design and fabricate a scale model equipped with oscillatory blowing to control flow separation.
- Integrate pressure disk methodology in OVERFLOW to model the effects of a rotor disk on a complex rotorcraft fuselage.
- Fabricate and test an isolated, instrumented baseline rotor for increased payload, reduced noise and vibration.

Total 2280

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	1979	2152	2257	2361
Adjustments to Appropriated Value	2034	1809		
FY 1998 Pres Bud Request	-205			
	1829	1809	2191	2280

Change Summary Explanation: Funding: FY 1997- Congressional reduction of basic research activities.

Project AH45

Page 16 of 66 Pages

Exhibit R-2 (PE 0601102A)

25

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE		DATE		PROJECT					
1 - Basic Research		0601102A Defense Research Sciences		February 1997		AH47					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH47	Applied Physics Research	2613	2751	3083	3207	3359	3489	3564	3688	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is to investigate the physics of various phenomena occurring in semiconductor structures, including thin heterostructure systems where quantum confinement effects are important. The basic knowledge learned will be applied to develop novel optoelectronic devices and test their performance. Active and passive optoelectronic components and subsystems will be developed that are of importance for Army systems. These include applications for Army optical control of microwaves, tactical wireless communications, and optical signal processing. From a logistical point of view it is important that the Army capitalize on advancements in semiconductor optoelectronics because of the potential for vastly reduced system size, weight, and cost as well as for the drastic improvements in system performance that optoelectronics can provide.

**FY 1996 Accomplishments:**

- 2613 -Performed research on novel integrated, loss-less optical splitter/phase shifter necessary for lightweight, low cost highly functional integrated photonic devices critical to Army communications-on-the-move systems and for fiber optic gyroscopes for missile guidance and global positioning. Investigated other concepts for higher functionality.
- Designed and demonstrated tunable multicolor quantum well infrared photodetector (QWIP) to provide high performance, low cost and highly manufacturable technology with unique capabilities for DoD and NASA's infrared imaging requirements.
- Continued research on spatial light modulator arrays necessary to implement fast optical processing architectures for automatic target recognition applications. Investigated issues involving optimization, novel functionalities and physical limitations of such devices.
- Increased operating temperature of an infrared hot-electron transistor (IHET) beyond 77 degrees K in the 10 micron range and optimized the IHET structure capable of detecting infrared radiation in the 15 micron range.
- Designed 2nd generation permanent magnet bias source for a 140 Ghz microwave tube and transfer to industry.

Total 2613

**FY 1997 Planned Program:**

- 2750 -Perform theoretical and experimental research to develop quantum cascade lasers in both As- and Sb-based materials systems.
- Perform research on GaSb/AlSb/InAs structures for novel broken-gap intersubband and interband emitter/detector structures.
- Analyze GPS and laser ranging data from GPS satellites to determine GPS accuracy (with NASA and University of Maryland).
- Perform research on integrated photonic laser/shifter/receiver to extend the capabilities of battlefield digitization.
- Demonstrate tunable waveguide modulator/detector at 800 nm.
- Design, fabricate, and test polarization independent waveguide modulator for Army communication systems.

Project AH47

Page 17 of 66 Pages

Exhibit R-2 (PE 0601102A)

26

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH47

## FY 1997 Planned Program: (continued)

- Investigate vertical cavity surface emitting laser (VCSEL) with strained active regions grown on (111)-oriented GaAs and compare their performance with (100)-oriented devices.
- Use VCSEL-based smart pixels on silicon and GaAs circuits to perform simple signal distribution tasks.
- Develop 815 nanometer reflection modulator for LADAR program.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2751

## FY 1998 Planned Program:

- 3083 -Determine the capability of vicinal step growth to fabricate quantum wires. Critically evaluate the potential of such quantum wires for device applications.
- Investigate novel semiconductor structures and their basic properties for applications in next generation devices
- Investigate microcavity effects for producing more efficient VCSELS and LEDs.
- Develop relativistically correct model for GPS within the framework of general relativity.
- Design and test anisotropically strained QW THz radiation detector for biological/chemical detection and radar ranging.
- Fabricate and test GaSb/AlSb/InAs based broken-gap interband and intersubband emitter/detector devices.

Total 3083

## FY 1999 Planned Program:

- 3207 -Demonstrate magnetic resonance microscopy concepts developed in collaboration with Johns Hopkins Applied Physics Lab under the microelectronics research cooperative program (MRCP).
- Develop quantum-wire based optoelectronic device structures.
- Develop techniques for fabricating coulomb-blockade tunneling structures for high speed switching applications.
- Develop VCSEL structures that exploit microcavity effects to enhance device performance.
- Develop improvements to GPS positioning algorithms for smart munitions.
- Develop VCSEL arrays with reduced polarization switching noise for signal processing applications.

Total 3207

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2582	3025	3155	3322
2653	2751		
-40			
2613	2751	3083	3207

Project AH47

Page 18 of 66 Pages

Exhibit R-2 (PE 0601102A)

27

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

AH48

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH48 Battlespace Information & Communications Res	0	6729	6199	7925	6988	6417	8617	8110	Continuing	Continuing

**A. Mission Description and Justification:** This project performs basic research in three technology areas: simulations, intelligent systems, and information survivability and vulnerability analysis. The project also supports the Army High Performance Computer Resource Center at the University of Minnesota.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 1817 - Demonstrate modeling techniques for fluid-body interactions including adaptive gridding and multi-body dynamics, establish 3D modeling capability for free surface flows in waterways, and demonstrate modeling techniques for fluid flow through fractured rock for radioactive waste cleanup and hazard assessment.
- 4755 - Investigate techniques that provide secure and survivable technologies, networks, and architectures. Initiate development of robust, adaptive, and fault tolerant networking protocols. Investigate secure techniques for mobile host protocols.
- - Investigate the application of software intelligent agents to C4I applications. Initiate the development of infrastructure for survivability and C4I software agents including human-agent, agent-agent, and agent-database interactions.
- 157 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

6729

**FY 1998 Planned Program:**

- 4515 - Continue refinement of selected techniques that improve security and survivability technologies, networks, and architectures. Develop and simulate secure mobility management techniques for mobile host protocols that support dynamic host reconfiguration.
- - Develop and simulate software intelligent agents for information system vulnerability assessment and other C4I applications.
- 1684 - Continue development of adaptive gridding, mesh moving, and multi-body modeling techniques. Apply these techniques to model paratrooper exit from large transport aircraft.
- - Continue development of modeling techniques for multi-phase fluid flow in porous media including biodegradation of contaminants.
- - Develop computational modeling techniques for the sintering process for manufacturer of ceramic crystal materials.

Total

6199

Project AH48

Page 19 of 66 Pages

Exhibit R-2 (PE 0601102A)

28

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH48

## FY 1999 Planned Program:

- 6261 - Demonstrate and validate secure mobility management techniques for mobile host protocols that support dynamic host configurations.
- 1664 - Demonstrate and validate software intelligent agents for vulnerability assessment and other C4I applications.
- Demonstrate numerical methods for real-time high performance geographic information systems which exploit scaleable computing architectures.
- Develop highly parallel solvers for sparse linear systems for applications to solve problems in fluid flow, structural mechanics, electromagnetics and heat transfer.
- Exploit emerging scaleable computing technologies at the Army High Performance Computing Research Center (AHPCRC).
- Demonstrate real-time, scaleable algorithms for vehicle multi-body simulations.
- Extend development of modeling advanced materials processing techniques of ceramic crystals.

Total 7925

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	11499	12805	13019
Appropriated Value	0	6729		
Adjustments to Appropriated Value				
FY 1998 Pres Bud Request	0	6729	6199	7925

Change Summary Explanation: Funding: FY 1997 - Congressional reduction of basic research activities.

FY 1998/FY 1999 - Funds reprogrammed for higher priority requirements.

Project AH48

Page 20 of 66 Pages

Exhibit R-2 (PE 0601102A)

29

Item 2

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH52

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH52 Equipment for the Soldier	941	831	1014	1056	1105	1145	1167	1192	Continuing	Continuing

**A. Mission Description and Justification:** Basic research focused on three core technology areas critical to the Soldier System: biotechnology, polymer science/textile technology and food technology. Research is targeted toward enhancing the mission performance, survivability, and sustainability of the soldier by advancing the state of the art in defense against battlefield threats and hazards such as ballistics, chemical agents, lasers, environmental extremes, and shortfalls in the availability of nutritious, satisfying rations essential to the health and well-being of soldiers.

**FY 1996 Accomplishments:**

- 351 -Characterized self-assembly of next-generation protein building blocks for development of new biosensors for laser eye protection.
- Probed intestinal immune system for targeted delivery of bioactive nutrients to improve immune response.
- Quantified constituent distribution affecting stability and texture of complex carbohydrate/protein ration components as a basis for enhancing ration shelf-life in the field.
- 590 -Characterized nonlinear optical properties of polymer-inorganic composites for laser eye protection applications.
- Performed mathematical modeling and experimental studies on textile systems as a means of understanding complex failure mechanisms.
- Improved breaking stress of PVA fibers through incremental fiber drawing for ballistic protection applications.
- Filed patents on biosensor arrays which provide technology for development of unique advanced materials for ballistic laser eye protection, counter surveillance and conducting ceramics.
- Investigated thin-film technologies to demonstrate self-assembling for controlled permeation for chemical/biological (CB) defense applications.
- Determined the physical properties of newly modified polymers for ballistic applications and measured ballistic performance using mechanics testing.
- Investigated mechanisms and yields of intrinsic chemical markers for assurance of improved thermal ration processes.

Total 941

**FY 1997 Planned Program:**

- 811 -Explore protective barriers based on "active" membrane systems leading to new methods to protect the soldier from chemical threats.
- Initiate molecular modeling of polymer interphases leading to the development of polymeric films and fibers with improved mechanical properties for ballistic and chemical agent protection.
- Design advanced ceramics for small arms protection at the molecular level to control crystal structure and improve performance.
- Initiate effort to develop new composite architectures for multifunctional membranes that exclude the transport of organic vapors, yielding an increased level of protection and comfort for chemical protective clothing.

Project AH52

Page 21 of 66 Pages

Exhibit R-2 (PE 0601102A)

30

Item 2

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AH52

## FY 1997 Planned Program: (continued)

- Initiate fabrication of conducting electroconductive polymer and photoresponsive protein composites with potential application to various optical devices, including individual laser eye protection.
- Investigate various plasticizers/moisture binders to ameliorate textural changes during storage of intermediate moisture ration items.
- Incorporate self-assembly techniques into newly developed ballistic silk fibers for further refinement of properties and characteristics for ballistic protection.
- Continue experimentally guided analytical work on fibers, fabrics, and fiber-resin systems for application to soldier survivability items.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

• 20  
Total 831

## FY 1998 Planned Program:

- 1014 - Bioengineer pore materials as second step in development of selectively permeable membranes for personnel protection against chemical threats.
- Characterize polymeric "interphases" for optimization of ballistic and chemical agent protective properties.
- Use thin-film technology, for the design of advanced ceramics, to control the organic-inorganic interfaces leading to lightweight ceramics for personnel protection.
- Leveraging the multidisciplinary university research initiative (MURI) for "functionally tailored fibers and fabrics", use the new eletrospinning technology to produce new membranes for chemical protective clothing.
- Immobilize proteins into assemblies to maximize signal transduction, providing technology for new materials for agile laser eye protection.

Total 1014

## FY 1999 Planned Program:

- 1056 - Engineer a triggering device for activating selectively permeable membranes for personnel chemical protection.
- Form larger samples of advanced ceramics for lightweight ballistic protection under optimal conditions to establish technology for producibility and for materials properties characterization.
- Conduct preliminary screening of new materials using "electrospinning" technology for the production of "seamless" chemical protective clothing.

Total 1056

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
964	988	1006	1030
991	831		
-50			
941	831	1014	1056

Project AH52

Page 22 of 66 Pages

Exhibit R-2 (PE 0601102A)



## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								BH57	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH57	Scientific Problems with Military Applications	53307	46812	58174	56475	56343	57313	56697	58230	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This extramural research project seeks to capture and exploit new scientific opportunities and technology breakthroughs, primarily at universities, to improve the Army's future operational capabilities. The Army Research Office maintains a strong peer-reviewed scientific research program through which technological improvements to warfighting capability can be assessed and implemented. Included are research efforts of scientific study and experimentation directed toward increasing knowledge and understanding in fields related to long-term national security needs and covering the physical sciences (physics, chemistry, biology, and mathematics), the engineering sciences (mechanics, electronics, computer, energy conversion, aeronautics, and materials), and the environmental sciences (atmospheric and terrestrial). It covers approximately 450 grants and contracts with leading academic researchers and over 800 graduate students yearly, and supports research at over 120 institutions in 41 states. Additionally, 5% of Army funding of university research is committed to Historically Black Colleges and Universities/Minority Institutions (HBCU/MI).</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 27056 -Conducted materials research on ultrahard diamond-like coatings for recoilless gun components.</li> <li>-Advanced research in electronic and optoelectronic structures for ultrafast processing with minimum energy dissipation for command and control on the digital battlefield.</li> <li>-Developed techniques for coherent infrared imaging, millimeter wave imaging, multiple wavelength detectors and temporal imaging to improve visibility.</li> <li>-Conducted biosciences research to develop microbiological and biochemical characterization of cells to break down military materiel waste.</li> <li>• 26251 -Designed adaptive intelligent control systems for multivariable and nonlinear systems with application to real-time implementation in embedded systems.</li> <li>-Conducted research in atmospheric sciences for accurate prediction of electromagnetic wave scattering cross section in the atmosphere; advanced terrestrial sciences knowledge of hydrologic runoff processes for large floods.</li> <li>-Developed "smart" structures concepts to suppress vibrations, reduce noise levels, and modify structural shapes of rotorcraft.</li> <li>-Provided fundamental information on energetic materials, ignition and combustion for ballistic models and developed elastomeric materials for lower cost, longer life, high performance plastics.</li> </ul> <p>Total 53307</p>											

Project BH57

Page 23 of 66 Pages

Exhibit R-2 (PE 0601102A)

32

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

BH57

## FY 1997 Planned Program:

- 23800 -Advance materials research in glassy metallic alloys for lightweight, ultrastrong composites with application to combat vehicle structures.
- Advance research in wireless communications, signal processing and efficient RF transmit/receive modules to enhance throughput of information supporting command and control for Force XXI.
- Advance research in mechanics to demonstrate a time-dependent, 3-D model of fuel injection, ignition and combustion dynamics to identify optimal ranges of engine operation.
- Increase the understanding of behavior of soil and cold climate materials in response to military operations with emphasis on vehicle-terrain interactions and interaction of precipitation with the ground.
- 22032 -Advance research in chemistry to create a new synthetic route to recyclable polymers with tailored properties.
- Advance computer science research to design a multi-protocol for the integration of symbolic, numeric, graphics and document processing into a single problem-solving environment for battle management.
- Advance biosciences research including deriving a novel photochromic material from bacteriorhodopsin.
- Explore nonlinear optical phenomena occurring in liquid crystal optical fibers for possible application for pulse compression, frequency conversion and other electro-optical applications.
- 980 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 46812

## FY 1998 Planned Program:

- 26403 - Advance electronics research to develop quasi-optical circuits with high efficiency and high power at high millimeter wave frequencies.
- Advance materials research to provide improved microstructural control of ceramics suitable for armor applications.
- Advance physics research to exploit the properties of nanometer-sized clusters of atoms to construct materials with unique functionality.
- 31771 - Advance chemistry research in dendrimers and hyperbranched polymers as a new class of nanoscopic building blocks.
- Advance research in the area of micro-mechanical mechanisms governing friction and wear of high temperature surfaces in engines.
- Advance knowledge-base sciences in critical issues of complex reasoning and machine learning for multimedia digital information environments.
- Advance biological sciences research in gene expression to determine the neural mechanisms that facilitate alertness and attention.
- Total 58174

## FY 1999 Planned Program:

- 25900 - Design electromagnetic adaptive materials and structures for sensing and monitoring applications and for camouflage.
- Develop 3-D microelectromechanical devices from high strength and high temperature materials to re-engineer heat engines at the micro level.
- Integrate analytical and numerical techniques of structural modeling with computer graphics and visualization methods for "smart" materials applications.

Project BH57

Page 24 of 66 Pages

Exhibit R-2 (PE 0601102A)

33

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

1 - Basic Research

0601102A Defense Research Sciences

BH57

## FY 1999 Planned Program: (continued)

- 30575 - Develop new antenna structures to optimize the new quasi-optical architectures.
- Advance biosciences research to develop mechanisms by which enzymes from thermophilic microorganisms can tolerate extreme temperatures.
- Conduct research in quantum computational analysis to develop revolutionary devices which can solve several types of "unsolvable" problems.
- Develop a wide range of metal matrix composites using modified models of mismatched induced superplasticity.
- Advance chemistry research to develop vesicles which can simultaneously visually identify the exact location of chemical agents and also destroy them.

Total 56475

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	54546	55707	57961	59299
Adjustments to Appropriated Value	56084	46812		
FY 1998 Pres Bud Request	-2777			
	53307	46812	58174	56475

Change Summary Explanation: Funding: FY 1997- Congressional reduction of basic research activities.

Project BH57

Page 25 of 66 Pages

Exhibit R-2 (PE 0601102A)

34

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

AH66

## 1 - Basic Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH66 Advanced Structures Research	1257	1287	1405	1465	1532	1590	1622	1669	Continuing	Continuing

**A. Mission Description and Justification:** This project is a joint Army/NASA effort that includes structures technology research into: structural integrity analyses; failure criteria; inspection methods which address fundamental technology deficiencies in both metallic and composite Army rotorcraft structures; use of composite materials in the design and control of structures through structural tailoring techniques; rotorcraft aeroelastic and aeromechanical stability; helicopter vibration (rotating and fixed systems); of design tools for improved helicopter structures with crashworthiness as a goal; and the control of aircraft interior noise levels. These areas have application to the development of design tools for improved helicopter structures and dynamic response. This structures-focused technology includes reductions in vehicle vibratory loads, improved vehicle stability, advanced fatigue methodologies for metallic structures, improved composites technology throughout the vehicle, and long-term development of an integrated stress-strength-inspection technology. These technologies will extend service life, reduce maintenance costs, and enhance the durability of existing and future Army vehicles. The improved tools and methods will enable the design and use of composite structures that can better address the cost, weight, performance, and dynamic interaction requirements of future platforms, and ultimately result in safer, more affordable vehicles. As agreed under Project Reliance, this is the only project for rotorcraft and ground structures basic research within the DoD. No related effort is being conducted within DoD.

## FY 1996 Accomplishments:

- 1257 - Performed numerical simulation study of active blade twist actuation for three conceptual piezoelectric helicopter blade designs, and correlated with CAMRAD -II analysis.
- Enhanced UMARC tilt rotor stability prediction with independent rotor-speed degree of freedom, and engine/drive-system dynamics modifications.
- Incorporated size effects in failure theories to predict large deformation damage, and published two papers.
- Conducted vertical drop test of Lear Fan fuselage section with modified energy absorbing composite subfloor, and correlated with DYCAST analysis.
- Successfully evaluated nearfield acoustic holography for improved interior noise measurement capability in aircraft fuselage section, using analytical Green's function.
- ASTM double cantilever beam (DCB) draft standard accepted by international standards organization (ISO).
- Developed 3D finite element analysis for local delamination in tapered composite laminates subjected to combined tension-torsion loads.
- Performed low velocity impact tests on sandwich panels to establish threshold of visible damage.
- Conducted parametric studies to assess propagation characteristics of cracks in fuselage panels.
- Conducted 2D finite element analysis (FEA) of as-produced composite rodpack microstructure to correlate local stresses with pull-off test results.

Total 1257

Project AH66

Page 26 of 66 Pages

Exhibit R-2 (PE 0601102A)

35

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE	February 1997	AH66
<b>1 - Basic Research</b>		<b>Defense Research Sciences</b>	
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1284 - Enhance the piezoelectric blade aeroelasticity analytical model and develop control laws to reduce blade vibrations.</li> <li>- Conduct CAMRAD II analyses to verify the load reduction potential of the active rotor system preliminary design.</li> <li>- Design, fabricate and bench test a prototype of a twist actuated actively controlled rotor blade as a preliminary evaluation for a complete rotor system.</li> <li>- Evaluate CAMRAD-II's ability to accurately predict rotor unsteady loads, and use it to design a rotor system that isolates structural properties most critical to rotor loads.</li> <li>- Conduct DYCAST analysis of assembled Lear Fan energy absorbing subfloor section to define the load transfer from the seat rail to the composite beams.</li> <li>- Refine KRASH model of full-scale Lear Fan aircraft to incorporate energy absorbing subfloor and conduct analysis prior to crash test.</li> <li>- Perform detailed evaluation of actuator selection technique for active interior noise control on a trimmed aircraft fuselage model.</li> <li>- Refine stationary nearfield acoustic holography formulation to include floor, and flight test evaluation in commuter class aircraft.</li> <li>- Publish ASTM test standard for Mode I DCB fatigue delamination onset of tapered composite laminates.</li> <li>- Conduct low velocity impact tests for thick composites made from glass and glass/ceramic hybrids.</li> <li>- Apply 3D FEA to calculate delamination fracture toughness criteria in tapered composite laminates.</li> <li>- Correlate fracture mechanics total life models which incorporate rotorcraft load interaction effects.</li> <li>- Develop finite element models (FEMs) of center-cracked stiffened panels to predict influence of rivet stiffness crack arrest.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p style="text-align: right;">3      1287</p> <p>Total</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1405 - Complete design and fabrication of actively controlled rotor system with integral active twist control, make required modifications to the ARES testbed, and conduct hover test.</li> <li>- Conduct CAMRAD-II analyses to guide wind tunnel experiments of active twist rotor blades with a focus on the development of control law definition.</li> <li>- Complete analytical investigation of effects of rotor blade aeroelastic parameters on rotor loads, and design model baseline rotor blades.</li> <li>- Modify comprehensive tilt rotor analysis to include capability of predicting stability of free-flight system including antisymmetric wing modes.</li> <li>- Perform aeroelastic response studies of tilt rotor systems with active controls for stability augmentation.</li> <li>- Publish results of experiments to study scaling effects in tensile coupons under large deformation.</li> <li>- Complete draft of peer reviewed paper on state-of-the-art in scaling of composite materials and structures</li> <li>- Retrofit second full-scale Lear Fan aircraft with energy absorbing subfloor beams, and conduct a full-scale crash test.</li> <li>- Validate damage resistance and residual strength models for low velocity impact of stitched composite panels.</li> <li>- Perform parametric studies to develop design criteria for rotorcraft flexbeam geometry anomalies.</li> </ul>			

Project AH66

Page 27 of 66 Pages

Exhibit R-2 (PE 0601102A)

36

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		DATE	PROJECT
1 - Basic Research		February 1997	AH66
PE NUMBER AND TITLE			
0601102A Defense Research Sciences			

## FY 1998 Planned Program: (continued)

- Validate 3D FEA composite flexbeam strength and fatigue life predictions for combined tension/torsion loading.
- Investigate benefits of secondary adhesive bonds and 3D reinforcements to increase composite stringer strength.
- Conduct parametric studies to determine influence of flexbeam layup and material form on strength and fatigue durability.
- Evaluate structural parameters to understand and control crack growth geometry in stiffened panels.
- Conduct crack-growth tests on multi-hole panel to validate small crack failure criteria.

Total 1405

## FY 1999 Planned Program:

- 1465 - Conduct hover and forward flight testing of twist actuated active rotor system in the Helicopter Hover Facility and the Transonic Dynamics Tunnel.
- Incorporate active control and smart material analytical models into comprehensive tilt rotor analysis, and correlate with tests of an actively-controlled stability augmentation system.
- Correlate KRASH model of the Lear Fan full-scale aircraft with data from crash test, and publish paper at American Helicopter Society (AHS) Forum.
- Publish Mode II and Mixed Mode test standards to measure delamination onset and fracture toughness of composite laminates.
- Develop probabilistic method for analyzing low velocity impact resistant in composite panels.
- Develop accept/reject criteria for flexbeams with manufacturing flaws.
- Develop fatigue analysis for arbitrary flexbeam layup under combined tension/torsion loads.
- Expand fatigue life predictive methods to use probabilistic distribution of flaw sizes to establish upper and lower failure bounds.

Total 1465

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
1268	1372	1391	1420
1302	1287		
-45			
1257	1287	1405	1465

Project AH66

Page 28 of 66 Pages

Exhibit R-2 (PE 0601102A)

37

Item 2

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

PROJECT

BH67

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH67 Environmental Research - Army Material Cmd	3811	4798	5709	4917	5575	5598	4603	4795	Continuing	Continuing

**A. Mission Description and Justification:** This project focuses basic research on innovative technologies for both industrial pollution prevention (P2) that directly supports the Army industrial base and for non-stockpile chemical warfare (CW) site remediation. The objective of the pollution prevention work is to invest in next generation manufacturing, maintenance, and disposal methods that will result in significantly reducing the usage of hazardous and toxic substances and their associated costs. The goal is to decrease the overall life-cycle costs of Army systems by 15-30% through the application of advanced pollution prevention technologies. The CW remediation efforts concentrate on the application of biotechnology in the characterization and physical clean-up of agent-contaminated soils and groundwater. The goal is to reduce the cost of remediating a site by at least 50% versus the use of conventional methods. Pollution prevention thrusts include: environmentally acceptable advanced non-radioactive, non-toxic and lightweight alternative structural materials to enhance weapon system performance; substitutes for ozone-depleting chemicals as solvents, refrigerants, and firefighting agents for military unique applications; energetic synthesis and process improvements to eliminate the use of hazardous materials and to minimize the generation of wastes from manufacturing operations; and surface protection alternatives to hazardous paints, cadmium, chromium, and chromate conversion metal and composite surfaces. CW thrusts include establishing the ecotoxicity of CW compounds, environmental fate and effect of CW compounds in soils and biodegradation of CW compounds. This project is linked to the Tri-Service Environmental Quality Research and Development Strategic Plan and addresses environmental technology requirements included in that plan.

## FY 1996 Accomplishments:

- 1914 - Applied genetic engineering techniques to both synthesis and bioconversion applications as a means for process optimization.
- Completed all basic research work in aqueous based degreasing and lightweight protective ceramics and initiated transition of all programs to applied research.
- Developed kinetic models for atmospheric fate of chloroflourocarbons (CFx) and other species for most promising halon alternative compounds (HACs); and performed quantum chemical simulations of infrared spectra for HAC decomposition products.
- 1897 - Conducted laboratory validations of plant studies and evaluated aquatic microcosm systems.
- Used the cytosensor to monitor status of soil microbial consortia.
- Optimized biodegradative systems for mustard and sarin and evaluated biosurfactant/nutrient addition treatments for remediation of soils.

Total 3811

## FY 1997 Planned Program:

- 3472 - Synthesize cyclic nitramine using enzymatic methods. Transition enzymatic work into "Green Energetics" program.
- Complete all basic research work in aqueous processing of fibers and composites and initiate technology transfer to exploratory development.
- Develop biotechnological methods to treat chemical warfare (CW) contaminated soil, determine CW agent fate, and assess environmental risk.

Project BH67

Page 29 of 66 Pages

Exhibit R-2 (PE 0601102A)

38

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

BH67

## 1 - Basic Research

## FY 1997 Planned Program: (continued)

- Release final report on halon alternative compounds research and transition to commercial sector for potential non-military applications.
- Identify an environmentally benign fluid that will eliminate volatile organic compounds (VOC) presently used to process pyrotechnic flares.
- 1216 - Funds to be reprogrammed to Project BT25 of this program element to expand environmental research to provide the basic knowledge needed to develop physical, chemical, and biological technologies to clean up Army contaminated sites; to maintain compliance and prevent pollution at Army installations; to complete validations and scaling comparisons and transition to site assessment and restoration programs and to conduct landform and ecological modeling.
- 110 - Small Business Innovative Research/Small Business Technology Transfer Programs.

Total 4798

## FY 1998 Planned Program:

- 1995 - Develop optimized microbial consortia to biodegrade CW agents/products.
- Identify supercritical fluid solvents for demilitarization/recycling of triple base propellant.
- Develop corrosion-resistant coatings, and plasma-based decoating technologies.
- 1410 - Complete fabrication and examination of specimens prepared with hollow, cylindrical, coating targets.
- Continue bioceramics Langmuir-Blodgett studies, reverse micelle, or other suitable systems to mimic natural processes.
- Conduct aqueous processing studies with elastomeric proteins for coatings.
- 804 - Complete characterization of energetic products and spent catalysts.
- Complete study of fundamental physical and chemical characteristics of propellants which influence the ballistic temperature coefficient during combustion.
- 1500 - Investigate chemical conjugates and other intermediate byproducts during biological degradation of explosives in soil.
- Investigate bio-geochemical fate of mixed organics and metals in seasonally frozen soils.
- Identify key ecological processes/interactions related to military impacts on ecosystems.
- Complete initial definition of the chemistry of photo degradation of nitroaromatic compounds under different experimental conditions.

Total 5709

## FY 1999 Planned Program:

- 1484 - Determine the major physico-chemical parameters controlling the fate of chemical warfare (CW) agents in soil.
- Optimize treatment procedures for enhancement of in-situ bioremediation of CW agents/products.
- Optimize techniques for supercritical fluid triple-base demilitarization/recycling and solvent-free energetic material analysis.
- Identify techniques for accelerating formation of self-assembled monolayer protective coatings.
- 1200 - Complete fabrication and examination of specimens prepared with wire-wrapped, solid, cylindrical, coating targets.
- Identify/develop aqueous degreasing and other promising systems.

Project BH67

Page 30 of 66 Pages

Exhibit R-2 (PE 0601102A)

39

Item 2

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>		<b>BH67</b>
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Modify bioceramics polymers to enhance properties and processing methods.</li> <li>- Complete solubility and microscopic evaluation for supercritical fluid processing of pyrotechnic binders.</li> <li>- Develop laboratory scale formulation for environmentally safe processing of energetic plasticizers.</li> <li>- Complete description of major biological degradation pathways of major explosive types; e.g., contaminant and media.</li> <li>- Combine low-temperature, bio-geochemical fate of mixed organics and metals with discontinuous permafrost models.</li> <li>- Establish cause/effect relationship of military stressors and ecosystem responses.</li> <li>- Define catalyst poisoning mechanisms in photo catalytic destruction nitroaromatics.</li> </ul>			
Total	4917		
<p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget</p> <p>Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request</p>			
		FY 1996	FY 1997
		5474	5707
		5627	4798
		-1816	
		3811	4798
			5709
			4917
<p>Change Summary Explanation: FY1996: Funds reprogrammed (-1663) to higher priority requirements.</p> <p>FY 1997: Congressional reduction of basic research activities.</p>			

Project BH67

Page 31 of 66 Pages

Exhibit R-2 (PE 0601102A)

40

Item 2

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

## 0601102A Defense Research Sciences

PROJECT

AH68

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH68 Processes in Pollution Abatement Technology	419	343	427	447	465	283	291	300	Continuing	Continuing

**A. Mission Description and Justification:** This project provides fundamental understanding of the physical, chemical and biological properties and mechanisms that control the degradation and treatment of hazardous wastes on military installations. This research is used to obtain basic technical information necessary for the design of treatment systems for both cleanup of existing hazardous waste sites and control of future hazardous waste generation. Wastes of concern include explosives, propellants, chemical agents and smokes. This project supports applied research efforts in program element 0602720A (Sensors and Electronic Survivability), Projects AF25 and DO48.

**FY 1996 Accomplishments:**

- 419 - Initiated enzymatic studies of explosives degradation.
- Identified bacterial cultures in RDX/HMX (explosives) biodegradation.

Total

419

**FY 1997 Planned Program:**

- 335 - Complete enzymatic studies of explosives degradation.
- Isolate/identify microbial genera and define pathways in nitrocellulose (NC), nitroglycerine (NG), and dinitrotoluene (DNT) degradation.
- 8 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

343

**FY 1998 Planned Program:**

- 427 - Provide implementation guidance on microbial destruction of TNT in soils.
- Complete studies on explosives bioprocessing in flow through bioreactors.

Total

427

**FY 1999 Planned Program:**

- 447 - Continue determination of fundamental microbiological processes impacting the biodegradation of explosives and their byproducts.
- Complete minimal growth requirements for bacteria involved with destruction of energetic wastes.

Total

447

Project AH68

Page 32 of 66 Pages

Exhibit R-2 (PE 0601102A)

41

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>AH68</b>	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	389	408	424
Adjustments to Appropriated Value	400	343	
FY 1998 Pres Bud Request	+19		
	419	343	427
			447
Change Summary Explanation: FY 1997: Congressional reduction of basic research activities.			

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

## 1 - Basic Research

BS04

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS04 Military Pollutants and Health Hazards	649	585	718	750	782	516	531	546	Continuing	Continuing

**A. Mission Description and Justification:** This project provides basic research in innovative, less costly, and less time consuming toxicity assessment methods for determining potential human health and environmental effects of military-unique hazardous wastes and chemicals, including explosives, propellants, and smokes. These new testing techniques will help to prioritize hazardous waste and waste treatment technologies and screen new Army chemicals for potential toxic effects. The work is conducted at US Army Biomedical Research and Development Laboratory (USABRDL) and US Army Center for Health Promotion and Preventive Medicine (CHPPM).

## FY 1996 Accomplishments:

- 649 - Explored improvements in specific environmental toxicity methods (USABRDL).
- Identified sentinel biomonitoring systems (USABRDL).
- Explored cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
- Identified methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).

Total 649

## FY 1997 Planned Program:

- 571 - Continue to explore improvements in specific environmental toxicity methods (USABRDL).
- Identify additional sentinel biomonitoring systems (USABRDL).
- Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
- Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 585

## FY 1998 Planned Program:

- 718 - Continue to explore improvements in specific environmental toxicity methods (USABRDL).
- Identify additional sentinel biomonitoring systems (USABRDL).
- Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRDL/CHPPM).
- Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).

Total 718

Project BS04

Page 34 of 66 Pages

Exhibit R-2 (PE 0601102A)

43

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>February 1997</b>	<b>BS04</b>
<b>FY 1999 Planned Program:</b> <ul style="list-style-type: none"> <li>750 - Continue to explore improvements in specific environmental toxicity methods (USABRD/L).</li> <li>- Identify additional sentinel biomonitoring systems (USABRD/L).</li> <li>- Continue exploration of cross-species extrapolation of non-mammalian bioassay systems (USABRD/L/CHPPM).</li> <li>- Refine identification of methods for integrated environmental assessment of contaminated sites at Army installations (USABRD/L).</li> </ul>			
Total	750		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	666	FY 1997	FY 1999
Appropriated Value	685	696	724
Adjustments to Appropriated Value	-36	585	748
FY 1998 Pres Bud Request	649	585	718
			750
Change Summary Explanation: Funding: FY 1997- Congressional reduction of basic research activities.			

Project BS04

Page 35 of 66 Pages

Exhibit R-2 (PE 0601102A)

44

Item 2

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

		DATE		February 1997							
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT							
1 - Basic Research		0601102A Defense Research Sciences		BS13							
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS13	Science Base/Medical Research Infectious Disease	8964	8253	10209	11357	11763	12169	12883	13145	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project funds basic research on medical countermeasures for naturally occurring diseases which are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>8964 - Determined that natural immunity occurs during re-infection with hepatitis E virus in non-human primates; established feasibility of a recombinant dengue vaccine in mice; characterized structure of certain key Hantaan macromolecules.</li> <li>- Initiated studies to identify key antigens of blood stage <i>Plasmodium vivax</i> capable of inducing protective immunity against relapsing malaria; explored selected antigens for incorporation in a skin test for the detection of leishmaniasis; established feasibility of a sensitive wicking assay for the identification of <i>P. falciparum</i> infected mosquitoes in forward areas.</li> <li>- Characterized the structure, function, and antigenicity of certain key ETEC macromolecules; established feasibility of using <i>in vitro</i> assays for evaluating drug resistance in scrub typhus isolates; characterized the structure of certain key <i>Campylobacter</i> macromolecules.</li> <li>- Established feasibility of a probe-based colorimetric polymerase chain reaction (PCR) assays for identification of hantaviruses, dengue viruses and sandfly fever viruses; established feasibility of a new dot blot assay for the detection of dengue infections; documented the introduction of dengue 2 virus into the Amazon region of Peru; continued identification of viruses isolated from mosquito pools during a Rift Valley Fever outbreak in 1993; established feasibility of using new methods for fermentation and purification of vaccine candidates for <i>shigella</i>, <i>Campylobacter</i>, malaria and dengue.</li> </ul> <p>Total 8964</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1938 - Characterize the immune response to <i>P. falciparum</i>, and identify protective antigens. Study correlates of immunity that can be predicted <i>in vitro</i>.</li> <li>1281 - Identify virulence factors of <i>Shigella</i>, <i>E. coli</i>, and <i>Campylobacter</i>. Characterize the immune response against these organisms.</li> <li>695 - Investigate parasite biology to support the antiparasitic drug effort. Conduct screening assays to support drug discovery, drug susceptibility, and resistance reversal.</li> <li>827 - Use genetic engineering to identify, isolate, clone, and produce selected antigens that are potential protective antigens in dengue fever. Investigate surrogate markers for long term immunity against dengue fever.</li> </ul>											

Project BS13

Page 36 of 66 Pages

Exhibit R-2 (PE 0601102A)

45

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE				BS13
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>				
<b>FY 1997 Planned Program: (continued)</b>					
• 960	- Investigate the mechanisms of resistance to antiparasitic drugs, and identify key antigens for the diagnosis of <i>Leishmania</i> . Investigate vector physiology as a source of novel vector control strategies.				
• 425	- Investigate ways in which outer membrane proteins of the meningitis organism can be preserved in native conformation. Develop fundamental information about the genes and proteins of rickettsial organisms.				
• 1161	- Pursue new methodologies to identify, cultivate, and characterize hemorrhagic fever and encephalitis viruses. Conduct epidemiology to determine the threat of hepatitis E in US Forces.				
• 765	- Select immunodominant antigens that are key to forward deployable diagnostic tests, and identify new candidate antigens and adjuvants to support improved vaccine production technology. Define the risk of emerging disease threats to US Forces.				
• 201	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.				
Total		8253			
<b>FY 1998 Planned Program:</b>					
• 2035	- Characterize the immune response to <i>P. falciparum</i> and <i>P. vivax</i> , and clone protective antigens. Investigate the induction of immunologic memory against key malarial antigens.				
• 1355	- Identify the full range of protective antigens of <i>Shigella</i> , <i>E. coli</i> , and <i>Campylobacter</i> . Clone the antigens that are the most promising vaccine candidates.				
• 957	- Clone and express novel parasitic antigens as targets for rational structure-based drug design. Analyze the antiparasitic activity of naturally occurring chemical compounds.				
• 872	- Use genetic engineering to prepare selected DNA sequences that are potential candidates for inclusion into a DNA vaccine against dengue fever.				
• 1013	- Investigate possible mechanisms to assess total parasite burden in infected personnel, and evaluate <i>in vitro</i> technologies for the diagnosis of leishmaniasis using serum antibody. Establish feasibility of controlling vectors by altering vector physiology.				
• 394	- Investigate antigenic variation and phase variation in the organism that causes meningitis. Identify key antigens in the immune response to rickettsial organisms.				
• 1116	- Clone and sequence genes of interest in hemorrhagic fever and encephalitis viruses. Express candidate vaccine and diagnostic antigens for hepatitis E virus.				
• 967	- Clone genes of key diagnostic antigens of interest to develop forward deployed diagnostics, and investigate technologies to deliver antigens and adjuvants to the immune system. Improve procedures for the collection and transport of clinical specimens under less than ideal conditions.				
• 1500	- Begin characterization of malaria genome.				
Total		10209			

Project BS13

Page 37 of 66 Pages

Exhibit R-2 (PE 0601102A)

46

Item 2

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

BS13

## 1 - Basic Research

## FY 1999 Planned Program:

- 2200 - Characterize the immune response to *P. falciparum* and *P. vivax*, clone protective antigens, and identify gene sequences that should be included in a DNA vaccine from data obtained from sequencing the entire malaria genome.
- 1430 - Identify key epitopes within the protective antigens of *Shigella*, *E. coli*, and *Campylobacter*. Investigate the adjuvant effect and other mechanisms to enhance mucosal immunity.
- 1150 - Perform structure activity chemical searches. Design new screening models to support drug discovery using fingerprinting to determine structure-activity relationships and from data obtained from sequencing the entire malaria genome.
- 1011 - Investigate possible surrogate markers for long term immunity to dengue fever.
- 1161 - Identify conserved parasite antigens that can serve as targets for diagnostic probes to detect drug resistant parasites, and investigate methods to increase the yields of *Leishmania* amastigotes to support studies.
- 416 - Investigate molecular mimicry in the organism that causes meningitis. Investigate antigenic diversity in rickettsial organisms.
- 1183 - Express candidate vaccine and diagnostic antigens for hemorrhagic fever and encephalitis viruses. Investigate antigenic diversity in hepatitis E virus.
- 1306 - Express candidate diagnostic antigens for forward deployed diagnostic tests, and investigate ways to preserve antigens during production. Provide training to host country physicians and scientists to enhance their role in the identification and reporting of new disease events.
- 1500 - Continue characterization of malaria genome.

Total

11357

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
9282	9815	10004	10244
9543	8253		
-579	0		
8964	8253	10209	11357

Change Summary Explanation: Funding: FY 1997- Congressional reduction of basic research activities.

FY 1999- Increase reflects decision to provide more emphasis to basic research in this area.

Project BS13

Page 38 of 66 Pages

Exhibit R-2 (PE 0601102A)

47

Item 2

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 1 - Basic Research

## 0601102A Defense Research Sciences

BS14

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS14 Science Base/Combat Casualty Care Research	4071	3749	4523	4702	4925	5118	5224	5346	Continuing	Continuing

**A. Mission Description and Justification:** This project conducts research to understand the basic mechanisms of combat related trauma. This research identifies trauma related topic areas, develops exploratory techniques, and initiates the experimental models necessary to support in-depth trauma research studies. This research is the basis for the development of trauma treatment and surgical procedures to extend the "brass 10 minutes" and achieve a "golden hour" following trauma injury, minimize lost duty time from minor battle and non-battle injuries, and provide military medical capabilities for far-forward medical/surgical care of battle and non-battle injuries.

## FY 1996 Accomplishments:

- 2004 - Characterized physiological effects of hemoglobin in animal models.
- Developed models for evaluation of fibrin-based hemostatic bandages to control hemorrhage.
- Continued microbiological surveillance of burn victims and explored role of endocrine and other mediators in burn wound infection and hypermetabolism.
- 2067 - Completed development of spinal cord injury model; continued to characterize effects of lead candidate neuroprotective compounds; evaluated protective effects of heat shock protein over expression.
- Identified critical physiological markers following hemorrhage and trauma for non-invasive sensor development; expanded inventory of potential "smart fiber" sensor materials to offer greater choices for minimally invasive measurements.
- Evaluated potential countermeasures to ameliorate smoke inhalation injury and improve outcome in a small animal injury model.

Total

4071

## FY 1997 Planned Program:

- 3658 - Explore feasibility of fibrin adhesives and foams for use in combat wounds. Begin identifying resuscitative technologies to ameliorate central and peripheral neural injury.
- Identify basic mechanisms of central nervous system damage occurring secondarily to trauma; explore basic mechanisms of organ failure in shock.
- Explore role of endocrine and other mediators in burn wound infection and hypermetabolism; continue microbiological surveillance of burn victims.
- Conduct animal testing of miniature, fiber optic, catheter-based blood gas monitor for base deficit determination.
- Conduct additional evaluations of potential countermeasures for smoke inhalation injury in small and large animal injury models; evaluate countermeasures for musculoskeletal injury.
- Explore feasibility of cartilage repair for high stress joint injuries and combat caused joint injuries.

Project BS14

Page 39 of 66 Pages

Exhibit R-2 (PE 0601102A)

48

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>February 1997</b>	<b>BS14</b>
<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Identify additional candidate technologies as non-invasive sensors, sensor fusion mechanisms or chip-based, local data-processing systems, to improve diagnostics and treatment decisions far forward.</li> <li>91 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 3749</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4523 - Demonstrate feasibility of "Smart Tourniquet."</li> <li>- Demonstrate feasibility of microwave warming catheter.</li> <li>- Test feasibility of medical decision assist algorithm.</li> <li>- Investigate feasibility of hemostatic spray for external and internal hemorrhages.</li> <li>- Investigate feasibility of "Lexin" as a candidate drug for prevention of ischemia/reperfusion injury in brain and spinal cord.</li> <li>- Explore feasibility of novel technologies or concepts to support research on dental trauma or maxillofacial injury.</li> </ul> <p>Total 4523</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4702 - Determine feasibility of high speed data acquisition and parallel processing in handling real-time acquired physiological data in a hand held or body worn computer.</li> <li>- Evaluate ability of medical decision assist algorithms to predictably triage and assist in deciding initial diagnoses.</li> <li>- Test feasibility of locally-applied oxygen to heal burn or other soft-tissue trauma wounds.</li> <li>- Investigate feasibility of various phospholipase A2 inhibitors and serine protease inhibitors for prevention of ischemia/reperfusion injury in brain, spinal cord, and other organs.</li> <li>- Determine feasibility of using text search engines as an enabling technology in medical translation.</li> </ul> <p>Total 4702</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget 4217 FY 1998 4546 FY 1999 4656</p> <p>Appropriated Value 4336</p> <p>Adjustments to Appropriated Value -265</p> <p>FY 1998 Pres Bud Request 4071</p> <p>Change Summary Explanation: Funding: FY 1997- Congressional reduction of basic research activities.</p> <p>Project BS14</p>			

Exhibit R-2 (PE 0601102A)

Page 40 of 66 Pages

49

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								BS15	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS15	Science Base/Army Operational Medicine Research	6654	5543	6094	6863	7139	7418	7574	7752	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The scientific and technical objectives for this project focus on physiological and psychological factors limiting soldiers' effectiveness, and on the characterization of health hazards generated by military systems and resulting from military operations. Research is conducted on military relevant aspects of environmental physiology and the neurobehavioral aspects of stress. The hazards of exposure to several classes of non-ionizing radiation directed energy, blast, jolt, vibration, noise, and military relevant toxic chemicals are also investigated under this project. Specific tasks include delineating injury and effect thresholds, mechanisms, and sites of action. Emphasis is on protection, sustainment, and enhancement of the physiological and psychological capabilities of military personnel under combat operations in all environments. Research efforts are categorized by five major thrust areas: operational medicine and performance; environmental extremes; directed energy bioeffects; toxic hazards health effects; and biodynamic stresses.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>6654 - Identified candidate compounds to enhance the restorative values of short duration sleep periods.</li> <li>- Characterized gender-related differences in susceptibility to heat-induced injuries.</li> <li>- Characterized the time-course of ocular injury from ultra short-pulse laser pulses.</li> <li>- Determined role of antioxidants in prevention of tissue damage from blast over pressure and toxic gas exposure.</li> <li>- Identified the cellular consequences of hyperthermia useful for heat stress prevention.</li> </ul>											
Total		6654									
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5407 - Characterize effects of antioxidant nutrients for preventing stress-induced suppression of immune function.</li> <li>- Identify nutritional and pharmacological strategies to reduce incidence and severity of cold-induced injuries.</li> <li>- Characterize the time course of injury from high-peak power, short-pulse duration microwave radiation.</li> <li>- Define the role of environmental chemical exposure and reactive oxygen activity on immunotoxicity.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>											
Total		136									
Total		5543									
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6094 - Test stress diagnostics for telemedicine use in forward identification of soldiers at risk for combat stress.</li> <li>- Identify nutritional and pharmacological strategies to reduce incidence and severity of altitude-related injuries.</li> </ul>											

Project BS15

Page 41 of 66 Pages

Exhibit R-2 (PE 0601102A)

50

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

BS15

## 1 - Basic Research

## FY 1998 Planned Program: (continued)

- Develop biomarkers of exposure to xenobiotic chemicals.
- Map laser retinal lesions to assess chronic effects of accidental off-axis exposure to current rangefinders/designators.

Total 6094

## FY 1999 Planned Program:

- 6863 - Develop *in vivo* photoreceptor imaging in primate models to enhance assessment of laser retinal injury and repair mechanisms.
- Evaluate candidate ergogenic aids suitable for ration supplementation to facilitate cognitive and psychomotor performance in Special Operations Forces (SOF) soldiers.
- Evaluate a multiple integrated sensor suite through a wireless body local area network (LAN) system to support telemedicine assessment of combat stress.

Total 6863

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
6884	6591	6931	7098
7078	5543		
-424	0		
6654	5543	6094	6863

Change Summary Explanation: Funding- FY 1997- Congressional reduction to basic research activities.

FY 1998- Funds reprogrammed (-837) to higher priority requirements.

Project BS15

Page 42 of 66 Pages

Exhibit R-2 (PE 0601102A)

51

Item 2

UNCLASSIFIED

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RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
1 - Basic Research		0601102A Defense Research Sciences								BS16																										
COST (in Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
BS16	Science Base/Combat Dentistry Research	464	459	0	0	0	0	0	0	0	923																									
<p><b>A. Mission Description and Justification:</b> This project supports biomedical research directed toward understanding basic biological mechanisms underlying repair of militarily-relevant maxillofacial injuries. This research is of fundamental importance to the development of treatments which enhance survival and sustain warfighting capability following battle and non-battle injuries.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>464 - Conducted strength testing of candidate materials, and fabricated and conducted mechanical testing of biodegradable bone screws.</li> <li>- Explored conventional and exotic fabrication techniques to replicate synthetic bone repair.</li> </ul> <p>Total 464</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>447 - Evaluate efficacy and safety of biodegradable bone screws in animal injury models.</li> <li>- Develop capability to fabricate bone replicas from 3-D in-house obtained data using CAD/CAM algorithms and in-house machine tools.</li> <li>12 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 459</p> <p><b>FY 1998 Planned Program:</b> Project tasks and funding restructured to PE 0601102A Project BS14.</p> <p><b>FY 1999 Planned Program:</b> Project tasks and funding restructured to PE 0601102A, Project BS14.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>482</td> <td>545</td> <td>558</td> <td>572</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>496</td> <td>459</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-32</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td></td> <td>464</td> <td>459</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding change in FY 1998 and 1999 reflects movement of project tasks and funding to Project BS14.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	482	545	558	572	Adjustments to Appropriated Value	496	459			FY 1998 Pres Bud Request	-32	0	0	0		464	459	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	482	545	558	572																																
Adjustments to Appropriated Value	496	459																																		
FY 1998 Pres Bud Request	-32	0	0	0																																
	464	459	0	0																																

Project BS16

Page 43 of 66 Pages

Exhibit R-3 (PE 0601102A)

52

Item 2

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE							DATE	PROJECT	
1 - Basic Research		0601102A Defense Research Sciences							February 1997	BS17	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS17	Molecular Biology/Military HIV Research	877	783	499	482	552	592	612	635	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides for basic research for early diagnosis and identification of technologies to design prevention and treatment of HIV. The present emphasis is on identification and comparison of HIV strains from many geographical locations, characterization of etiologic agents and definition of tests for epidemiological surveys to design a vaccine to prevent disease. Current policy prohibits OCONUS assignments of antibody positive service members. A safe and effective vaccine for prevention of infection and intervention will permit all service members to become worldwide deployable.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>858 - Identified key genomic differences among various clades (strains) of HIV-1 that are important considerations for vaccine development.</li> <li>- Demonstrated trans-global migration of diverse HIV genotypes via infection of U.S. military and U.N. peacekeeping forces deployed abroad.</li> <li>- Demonstrated rising incidence of AZT-resistant virus in seroconverting HIV-infected persons.</li> <li>19 - Identified key genomic differences among various clades (strains) of HIV-1 that are important considerations for vaccine development.</li> </ul> <p>Total 877</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>764 - Evaluate preclinically oligomeric proteins as vaccine candidates based upon information obtained from worldwide variability of the HIV genome.</li> <li>- Study transmission kinetics of newly-introduced HIV types.</li> <li>- Determine potential for an alphavirus-vectored HIV DNA recombinant vaccine construct.</li> <li>19 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 783</p>											
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>499 - Evaluate HIV sub-unit peptides as vaccine candidates to combat worldwide HIV strains.</li> <li>- Develop methods to evaluate international threat assessment of HIV strains.</li> <li>- Complete study of transmission kinetics of newly introduced HIV recombinant strains.</li> </ul> <p>Total 499</p>											
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>482 - Develop methods to evaluate the international threat of various HIV strains.</li> </ul> <p>Total 482</p>											
Project BS17											

Exhibit R-2 (PE 0601102A)

Page 44 of 66 Pages

53

Item 2

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>BS17</b>	
<b>B. Project Change Summary.</b>			
FY 1997 President's Budget	FY 1996 908	FY 1997 932	FY 1998 999
Appropriated Value	933	783	1024
Adjustments to Appropriated Value	-56	0	
FY 1998 Pres Bud Request	877	783	499
			482
Change Summary Explanation: Funding: FY 1997 - Congressional reduction to basic research activities. FY 1998/FY 1999 - Funds reprogrammed (FY 1998, -500; FY 1999, -542) to higher priority requirements.			

Project BS17

Page 45 of 66 Pages

Exhibit R-2 (PE 0601102A)

54

Item 2

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

## 0601102A Defense Research Sciences

PROJECT

BS18

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BS18 Marine Derived Biocatalysts	0	636	0	0	0	0	0	0	0	636

**A. Mission Description and Justification:** Biocatalysts (enzymes) which degrade organophosphorus chemical agents and other hazardous defense industry-related materials will be isolated from marine microorganisms. Gene codings for the production of these biocatalysts will be cloned and expressed in suitable bacterial or insect cell systems and produced by fermentation in large scale (i.e. gram). Both genetic and bioreactor variables will be optimized for efficient biomanufacture of active, stable, hazardous material degrading enzymes.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 620 - Isolate and purify Organophorus Acid Anhydrolase and other hydrolytic or oxidoreductase enzyme candidates and test activity.
- Clone genes and express in suitable vector.
- Scale up fermentation and produce gram quantities.
- 16 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 636

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	0	0	0
Appropriated Value	0	636		
Adjustments to Appropriated Value				
FY 1998 Pres Bud Request	0	636	0	0

Change Summary Explanation: FY 97 funding reflects Congressional add for this special interest item.

Project BS18

Page 46 of 66 Pages

Exhibit R-2 (PE 0601102A)

55

Item 2

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AT22

COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT22	Soil and Rock Mechanics	1897	1730	2095	2180	2281	2369	2416	2470	Continuing	Continuing

**A. Mission Description and Justification:** Basic research in this project develops the fundamental knowledge base required by the Army in the field of civil engineering. Current emphasis is on: determining and quantifying the non-linear, hysteretic response of deformable soils to transient loadings resulting from high-speed curvilinear vehicle maneuver; defining the constitutive behavior and penetration mechanics (including plastic deformation and microfracture mechanics) associated with projectile impact on complex geologic and structural materials; development of mathematical models needed for first principle analyses of explosive-induced ground shock and high-velocity projectile impact; development of analytic models and advanced construction materials for the design and construction of permanent or expedient operating surfaces both within CONUS and within a theater of operations; investigation of soil electromagnetic properties that affect in-situ obstacle discrimination and development of adaptive or responsive construction materials suitable for camouflage, concealment, and deception measures for fixed or semi-fixed assets. These technologies provide the basis for applied research to provide: analytical capabilities for mobility assessments; hardened battlefield positions, fixed facilities, and semi-fixed assets; multispectral camouflage, concealment, and deception for fixed facilities; and advanced vertical and horizontal construction materials in PE 0602784A (Military Engineering Technology), Project AT40.

**FY 1996 Accomplishments:**

- 1897 - Developed pavement fracture and durability mechanics models for application in predicting pavement performance.
- Quantified performance parameters of advanced high-strength structural materials for anti-penetration shields/hardened structures.
- Validated soil/climatological relationships for soil-moisture strength prediction in humid microthermal, undifferentiated highland, and humid esothermal climates.
- Provided quantitative recommendations for designing/selecting a sensor suite for in-situ discrimination applications.
- Performed quantitative evaluations and matching of selected responsive/passive materials to backgrounds.

Total 1897

**FY 1997 Planned Program:**

- 1688 - Develop first-principle computer code to calculate long-rod penetrator performance during normal impact against concrete targets.
- Document soil/climatological relationships for predicting/evaluating soil-moisture strength world wide.
- Develop substrate specifications for materials to host responsive/passive concealment and camouflage deception (CCD) laminate materials.
- Develop dynamic constitutive models for pavement materials and continue formulation of traffic distribution model.
- 42 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1730

Project AT22

Page 47 of 66 Pages

Exhibit R-2 (PE 0601102A)

56

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AT22

## FY 1998 Planned Program:

- 2095 - Conduct subscale tests and calculational analyses of hard-target penetrators against advanced concretes.
- Determine appropriate combinations of responsive/passive composite materials as a function of environment and facility type.
- Validate models for predicting the durability and dynamic behavior of pavement materials.
- Develop field measuring devices to collect loading patterns of soil response to tracked vehicles.

Total 2095

## FY 1999 Planned Program:

- 2180 - Complete first-principle code calculations simulating oblique-impact long-rod penetration tests against concrete targets.
- Incorporate selected responsive/passive materials into/onto substrate host.
- Complete analytical models for predicting traffic distribution, cohesive soil moisture response, and compaction behavior.
- Conduct full-scale soil loading experiments for representative sample of tracked vehicles

Total 2180

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

1946

2000

-103

1897

FY 1997

2057

1730

FY 1998

2139

FY 1999

2210

2180

Change Summary Explanation: Funding: FY 1997- Congressional reduction to basic research activities.

Project AT22

Page 48 of 66 Pages

Exhibit R-2 (PE 0601102A)

57

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997	PROJECT AT23
BUDGET ACTIVITY		PE NUMBER AND TITLE										
1 - Basic Research		0601102A Defense Research Sciences										
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost	
AT23 Basic Research/Military Construction		1788	1500	1818	1892	1979	2054	2095	2143	Continuing	Continuing	

**A. Mission Description and Justification:** This project supports development of fundamental knowledge essential to develop the leap ahead technologies required to solve Army and Defense (via Project Reliance) unique problems in the planning, programming, design, construction, and sustainment of force projection platforms and energy and utility infrastructure to achieve the infrastructure cost reduction goals of the current national military strategy. This project supports exploratory development efforts in Program Element 0602784A ( Military Engineering Technology), Projects AT41 and AT45. This project also supports related Defense Modeling and Simulation Office-funded applications, and has significant dual-use application potential.

**FY 1996 Accomplishments:**

- 1788 - Incorporated abstract models that relate graphical display to mental models of users from different engineering disciplines.
- Developed capability to integrate collaborative software systems.
- Developed algorithms to predict post-elastic structural response of single degree of freedom systems under tri-axial loading.

Total 1788

**FY 1997 Planned Program:**

- 1463 - Investigate models for self-responding composites for infrastructure applications.
- Develop models to predict the behavior of materials under load histories simulating earthquakes.
- 37 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1500

**FY 1998 Planned Program:**

- 1818 - Develop engineer interaction protocols, common facility component representations, and facility knowledge-sharing algorithms to enable the development of an open collaborative engineering designer system.
- Develop an understanding of active magnetostriuctive tagging of construction materials for monitoring structural health.
- Develop understanding of full 3-D behavior of steel building systems via testing on tri-axial shock test facility.

Total 1818

Project AT23

Page 49 of 66 Pages

Exhibit R-2 (PE 0601102A)

58

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>		<b>AT23</b>																									
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1892 - Develop collaborative engineering methodologies to enable asynchronous design and engineering of facilities.</li> <li>- Characterize electrical time domain reflectometry for evaluation of structural health of large concrete structures.</li> <li>- Continue 3-D response analysis of steel buildings.</li> </ul> <p>Total 1892</p>																												
<p><b>B. Project Change Summary</b></p> <table border="0"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>1737</td> <td>1784</td> <td>1844</td> <td>1889</td> </tr> <tr> <td>Appropriated Value</td> <td>1785</td> <td>1500</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated value</td> <td>+3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>1788</td> <td>1500</td> <td>1818</td> <td>1892</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	1737	1784	1844	1889	Appropriated Value	1785	1500			Adjustments to Appropriated value	+3				FY 1998 Pres Bud Request	1788	1500	1818	1892
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	1737	1784	1844	1889																								
Appropriated Value	1785	1500																										
Adjustments to Appropriated value	+3																											
FY 1998 Pres Bud Request	1788	1500	1818	1892																								
<p>Change Summary Explanation: Funding: FY 1997- Congressional reduction to basic research activities.</p>																												

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								AT24	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT24	Snow, Ice and frozen Soil	1210	1104	1343	1399	1462	1517	1547	1581	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project is the only focused DoD basic research program investigating the physical, chemical, and electrical properties of snow, ice, and frozen soil and characterization of dominant winter and cold regions processes impacting military materiel, operations, and facilities. It provides the knowledge base for exploratory development to support modeling and simulation and product improvements as well as leading to reduced life-cycle costs and increased readiness and operability in extreme cold, high altitude and seasonal winter conditions around the world. Products are directly input to PE 0602784A (Military Engineering Technology), Project AT42, as well as specific Navy and Air Force science and technology efforts, and forms the basis for much civilian applied research in these areas. It provides the fundamental knowledge base for developing concepts and approaches to upgrade materiel and doctrine for more effective performance in these challenging conditions.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1210 - Developed concept for integrated millimeter wave (MMW)/infrared (IR) signature modeling for snow-covered terrain.</li> <li>- Modeled freezing effects on soil chemistry and behavior.</li> <li>- Defined effects of electrical charging on snow friction and evaluated snow as a chemical absorption agent.</li> </ul> <p>Total 1210</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1077 - Develop first principles radar scattering model for ice.</li> <li>- Develop 2- and 3-D models for freeze/thaw process for saturated soils.</li> <li>- Develop analysis of atmospheric icing persistence; develop a dynamic model of ice inclusion size distribution.</li> <li>• 27 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 1104</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1343 - Quantify the rapid and dynamic evolution of millimeter wave radar response in temperate snow conditions.</li> <li>- Parameterize role of snow cover in turbulent exchange of heat and moisture in boundary layer.</li> <li>- Quantify dominant acoustic propagation processes for mapping snow-covered terrain.</li> </ul> <p>Total 1343</p>											

Project AT24

Page 51 of 66 Pages

Exhibit R-2 (PE 0601102A)

60

Item 2

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

PROJECT

AT24

## FY 1999 Planned Program:

- 1399 - Develop vectorized wave propagation code for viscoelastic/porous media.
- Define lab to geophysical scale effects on mechanical behavior of ice.
- Explore fundamental relationships between physical and electrical properties of ice.

Total 1399

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

1241

1276

-66

1210

FY 1997

1313

1104

1104

FY 1998

1337

1343

FY 1999

1369

1399

Change Summary Explanation: Funding: FY 1997- Congressional reduction to basic research activities.

Project AT24

Page 52 of 66 Pages

Exhibit R-2 (PE 0601102A)

61

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT		
1 - Basic Research		0601102A Defense Research Sciences								BT25		
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost	
BT25	Environmental Research - Corps of Engineers	4725	3070	3608	4001	3749	3757	3091	3214	Continuing	Continuing	
<p><b>A. Mission Description and Justification:</b> This project provides the basic research needed to develop the technologies to address Army issues in the cleanup, compliance, conservation, and pollution prevention areas. The focus in cleanup provides the basic knowledge needed to develop physical, chemical and biological technologies to clean up the Army's contaminated sites. In compliance and pollution prevention, efforts address knowledge gaps vital to maintaining compliance and preventing pollution at non-industrial installations. The focus in conservation is on landform and ecological modeling, the feasibility of development and propagation of resilient plant species for rehabilitation of damaged lands, and fundamentals of training and test activity noise as they might be applied to reducing adverse effects on mission activities. This project will also examine the underlying requirements for comprehensive environmental modeling and simulation products to address environmental issues. The project supports exploratory development efforts in PE 062720A (Environmental Quality Technology), Projects AF25, D048, and A896. 65% of the funds in this project are used to support extramural research via a Broad Area Announcement requesting work supporting in-house laboratory efforts.</p>												
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 4725 - Developed species risk and richness models.</li> <li>- Developed fundamental understanding of impulse sound propagation.</li> <li>- Investigated fundamental mechanisms of spectral response for contaminant identification and quantification.</li> <li>- Investigated solute exclusion and contaminant transport for frozen, snow-covered and ice-covered regimes and wetlands.</li> <li>- Initiated research to understand the role of biodiversity in ecosystem integrity.</li> <li>- Continued development of geomorphological process modeling for archeological site and soil erosion predictions.</li> </ul>												
Total		4725										
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2995 - Evaluate remote monitoring technologies for threatened and endangered species responses to Army training.</li> <li>- Develop erosion control techniques using cryptogamic soil crusts.</li> <li>- Identify fundamentals of spatial data visualization and registration.</li> <li>- Investigate fundamental science of biosensor technology for application to cleanup site characterization.</li> <li>- Evaluate soil, snow, ice, and contaminant parameters necessary to provide data fusion to describe contaminant transport processes in cold regions.</li> <li>- Determine transportation mechanisms in heterogeneous multiphase soil systems.</li> <li>• 75 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>												
Total		3070										
Project BT25												

Exhibit R-2 (PE 0601102A)

Page 53 of 66 Pages

62

Item 2

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

BT25

## FY 1998 Planned Program:

- 3608 - Explore innovative site characterization sensor technologies and fundamental effects of complex media/contaminant interactions on sensor responses.
- Continue mathematical formulations for multi-contaminant groundwater transport mechanisms and analyze characteristics in heterogeneous media.
- Investigate bio-geochemical processes at low/freezing temperatures with quantified rates of activity and suppression/stimulation.
- Continue investigation of chemical conjugates and other intermediate byproducts during biological degradation of explosives in soil.
- Identify reaction mechanism and pathway for electrochemical reduction of energetic compounds in water.
- Develop an integrated hillslope and channel evolution model as an investigation and prediction tool.

Total 3608

## FY 1999 Planned Program:

- 4001 - Explore fundamentals of physical/chemical response of unexploded ordnance on candidate detection sensors.
- Improve theory, scaling, and computational tools for simulating fate and transport of contaminants in groundwater.
- Explore fundamentals of organic compound fate in freeze-thaw environments and combined biological/geochemical/geophysical measurement and detection.
- Complete description of major biological degradation pathways of major explosives types; e.g., contaminant and media.
- Develop kinetic and mechanistic understanding of sonochemical destruction of nitro-containing compounds.
- Determine plant varieties with improved resilience to military traffic and suitable for revegetation of training lands.

Total 4001

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
3480	3652	3696	4073
3579	3070		
+1145			
4725	3070	3608	4001

Change Summary Explanation: Funding: FY1996- Funding increased (+\$1145K) to investigate solute exclusion and contaminant transport for frozen, snow-covered and ice-covered regimes and wetlands and to understand the role of biodiversity in ecosystem integrity.

FY 1997- Congressional reduction to basic research activities.

Project BT25

Page 54 of 66 Pages

Exhibit R-2 (PE 0601102A)

63

Item 2

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								A305	
COST (in Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A305	Automatic Target Recognition Research	1034	1132	1186	1237	1292	1340	1368	1409	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project focuses on the battlefield environment with its very challenging ground clutter problem, including areas not being addressed by the other Services, such as: automatic model-based generation of automatic target recognition (ATR) search trees; ATR physically implemented on the focal plane array; model-based automatic recognition of one dimensional infrared signals (chemical detection); information-based theories applied to target signature analysis; and low depression angle, short range scene modeling for target acquisition and endgame.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>1034 -Extended recent advances made in speech and handwriting recognition to develop a hierarchical hybrid neural model-based ATR algorithm structure for the 2-D ATR problem.</li> <li>-Investigated recent advances in the sciences of combinatorial optimization and computational geometry to approach near optimal search solutions for ATR algorithms.</li> <li>-Developed modeling techniques which allow the extension of multi-spectral scene generation (MSSG) to synthetic environment applications.</li> </ul> <p>Total 1034</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1124 -Develop hierarchical syntax/grammar for hybrid neural model-based ATR algorithms to include higher level model structures.</li> <li>-Apply learning theory to the ATR problem in order to automate the feature selection process.</li> <li>-Develop techniques for extension of MSSG to real-time virtual reality environment.</li> <li>8 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 1132</p>											
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1186 -Provide single frame synthetic aperture radar/forward looking infrared/television (SAR/FLIR/TV) compression algorithm for tactical reconnaissance, surveillance, and target acquisition (RSTA) and munitions communication links.</li> <li>-Extend FLIR ATR algorithm performance to include limited on-the-fly training.</li> <li>-Extend existing two-sensor (FLIR/Laser Radar (LADAR) or FLIR/Millimeter Wave (MMW)) fusion ATR algorithms to other dual sensor combinations (i.e., FLIR/Visible, Visible/LADAR, Visible/MMW, etc.)</li> </ul> <p>Total 1186</p>											
Project A305										Exhibit R-2 (PE 0601102A)	

Page 55 of 66 Pages

64

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

A305

## FY 1999 Planned Program:

- 1237 -Provide real-time multi-frame electro-optic (EO) detection and compression algorithms for FLIR for use on existing battlefield communication links.
- Enhance 2nd generation FLIR ATR capabilities to handle targets at 4km ranges.
- Extend FLIR/MMW/LADAR ATR algorithms to operate in up to 40% occlusion.

Total

1237

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

1045

1073

-39

1034

FY 1997

1156

1132

1132

FY 1998

1182

1186

FY 1999

1214

1237

Project A305

Page 56 of 66 Pages

Exhibit R-2 (PE 0601102A)

65

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

A31B

COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A31B	Infrared Optics Research	2075	2233	2330	2425	2538	2637	2693	2771	Continuing	Continuing

**A. Mission Description and Justification:** This project sustains the Army's theoretical and experimental research in night vision and electro-optic technologies. It generates new technology to obtain unprecedented awareness of the battlefield to continue to "own the night," notwithstanding increased foreign competition. To achieve these objectives, focal plane arrays with significantly improved performance for major platforms and low cost night vision aids that allow for a wide distribution will be required. Therefore, research is focused on materials, devices and techniques required for the development of high performance smart dual color staring infrared focal plane arrays (IRFPAs) and uncooled IRFPAs with moderate performance. For the high performance IRFPAs, mercury cadmium telluride (HgCdTe) detector arrays and quantum well infrared photon detector (QWIPs) are investigated. Research for uncooled IRFPAs is based on thin film ferro-electric materials and the development of novel detector architectures with improved thermal isolation structures. Uncooled IRFPAs will also have significant civilian applications.

**FY 1996 Accomplishments:**

- 2075 -Fabricated blue/green laser diodes for compact, efficient, visible laser sources and demonstrated room temperature operation for high efficiency pumping of visible laser sources for optical countermeasures and non-lethal weapons.
- Delivered an optimized, efficient 3-5 mm optical parametric oscillator (OPO) to provide tunable laser output in the required wavelength bands for IR countermeasures (IRCM).

Total

2075

**FY 1997 Planned Program:**

- 2233 -Develop processing techniques for thin film ferroelectric materials.
- Optimize film deposition techniques.
- Determine optimum application for competing QWIP structures.
- Demonstrate feasibility of HgCdTe dual color design.

Total

2233

**FY 1998 Planned Program:**

- 2330 -Develop thin film ferro-electric detector test structures.
- -Demonstrate dual color QWIP detector array with improved quantum efficiency.
- -Demonstrate dual color HgCdTe detector array for increased temperature operation.

Total

2330

Project A31B

Page 57 of 66 Pages

Exhibit R-2 (PE 0601102A)

66

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

A31B

## FY 1999 Planned Program:

- 2425 -Demonstrate advanced thin film ferroelectric uncooled IRFPA.  
-Integrate smart pixel technology with QWIP and HgCdTe detector array.

Total

2425

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
2083	2281	2326	2379
2141	2233		
-66			
2075	2233	2330	2425

Project A31B

Page 58 of 66 Pages

Exhibit R-2 (PE 0601102A)

67

Item 2

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								B52C	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B52C	Mapping and Remote Sensing	2408	2196	2655	2763	2892	3003	3066	3137	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project supports research in fundamental topographic sciences to improve the tactical commander's knowledge of the battlefield; to extract natural and man-made features from reconnaissance imagery in near-real time; to exploit terrain reasoning/artificial intelligence techniques for distributive interactive simulation and for combat planning and operations; to support unmanned/autonomous vehicle navigation using sensor enhanced dynamic data bases; and to explore the potential of space technology to provide real-time terrain intelligence, command and control, and targeting support. The research provides the theoretical underpinnings for Program Element 0602784A (Military Engineering Technology), Project A855.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2408 - Investigated techniques to automatically upgrade the accuracy and density of standard (Defense Mapping Agency and US Geological Survey) digital elevation data and designed an open architecture system for processing spectral data to support terrain visualization and environmental monitoring.</li> <li>- Assessed complex neural net architectures for feature extraction and image classification and performed 3-D image compression with wavelet transformations.</li> <li>- Investigated the application of multiple sensors for detecting and monitoring environmental issues; integrated hyperspectral data and imagery with geographic information systems.</li> </ul> <p>Total 2408</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2142 - Perform terrain feature extraction using multispectral/interferometric synthetic aperture radar (IFSAR) data.</li> <li>- Incorporate interactive orthophoto refinement into digital elevation model software.</li> <li>- Study and assess factors contributing to the overall reliability of terrain analysis models.</li> <li>• 54 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 2196</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2655 - Develop terrain feature extraction protocols from integrated multispectral/hyperspectral/IFSAR imagery.</li> <li>- Devise neural network image data classification capability.</li> <li>- Examine the effects of the terrain data layers on the reliability of terrain analysis models.</li> </ul> <p>Total 2655</p>											
Project B52C		Page 59 of 66 Pages								Exhibit R-2 (PE 0601102A)	

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601102A Defense Research Sciences

PROJECT

B52C

## FY 1999 Planned Program:

- 2763 - Assess laser-induced fluorescence technologies for extraction of terrain features, targets, and environmental information.
- Investigate prototype digital elevation model high resolution, large area software.
- Create reliability coefficients for imagery-derived terrain data layers for use in terrain analysis models.

Total

2763

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

2471

2539

-131

2408

FY 1997

2612

2196

2196

FY 1998

2663

2655

FY 1999

2726

2763

Change Summary Explanation: Funding: FY 1997- Congressional reduction to basic research activities.

Project B52C

Page 60 of 66 Pages

Exhibit R-2 (PE 0601102A)

69

Item 2

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

B53A

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B53A Battlefield Environment and Signature	5407	3530	3672	3822	4003	4160	4249	4378	Continuing	Continuing

**A. Mission Description and Justification:** This project provides in-depth understanding of the complex atmospheric behavior associated with electro-magnetic propagation, transport and diffusion, and remote sensing, which affect Army operations and systems such as electro-optics, smoke deployment and target designators. The project also includes research in techniques for C<sup>2</sup> natural language and logic-based reasoning systems. The project supports Project Reliance sub-areas of lower atmospheric sciences and terrestrial sciences with a lead role in boundary layer processes and interactions over terrain.

## FY 1996 Accomplishments:

- 2872 - Developed adaptive optical system for mitigation of severe atmospheric-induced phase distortions affecting optical systems.
- Developed analytical solutions to the nonlinear stochastic Navier-Stokes equations to provide ultra-fast meteorological and turbulence predictions over complex terrain and structures of military significance on the digitized battlefield.
- Developed a model for boundary layer coherent structures over vegetation.
- Investigated the utility of fluorescence excitation and emission spectra for differentiating between biological and non-biological aerosol.
- 2535 - Incorporated wind effects and turbulence into 3-dimensional acoustic propagation model.
- Developed the methodology for mitigation of atmospheric effects in visible color imagery.
- Integrated user definable geotypical dynamic terrain into synthetic environments.
- Developed dynamic data transformation approach to support real-time visualization of environmental effects.

Total

5407

## FY 1997 Planned Program:

- 3530 - Perform basic research towards the development of a new generation of self-learning, self-adapting, passive all-optical systems based on neural network principals.
- Develop analytical solutions to the coupled nonlinear atmospheric diffusion-advection, Navier-Stokes and propagation equations to provide ultra-fast solutions for obscuration, chemical and biological hazard prediction on the digitized battlefield.
- Define and characterize the diurnal behavior of the atmospheric boundary layer.
- Develop a laser-based method for rapid point detection of bio warfare agents.
- Complete prototype 3-dimensional acoustic propagation model for inclusion into acoustic decision aid.
- Develop a complete suite of models for characterization and visualizing the battlespace atmospheric environment.

Total

3530

Project B53A

Page 61 of 66 Pages

Exhibit R-2 (PE 0601102A)

70

Item 2

UNCLASSIFIED



## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																				
BUDGET ACTIVITY	PE NUMBER AND TITLE																						
<b>1 - Basic Research</b>	<b>0601102A Defense Research Sciences</b>	<b>February 1997</b>	<b>B53A</b>																				
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3672 - Test and validate the boundary layer model of airflow over complex terrain and within and above vegetative canopies and built-up areas for Army tactical scales.</li> <li>- Develop horizontal transient turbulence theory (an alternative method of describing the effects of turbulence, capable of handling the realistic case of multiscale effects in a single step, substantially reducing computation time), including surface layer effects.</li> <li>- Demonstrate the capability of a portable, biowarfare agent, point detector at a major field test in conjunction with the Army Edgewood Research, Development, and Engineering Center; determine fluorescence signatures of polydisperse aerosols.</li> <li>- Incorporate horizontal radiative transport into the boundary layer illumination and radiative balance model to improve contrast calculations for target acquisition.</li> <li>- Complete a prototype 3-D acoustic propagation model for inclusion into acoustic decision aids.</li> <li>- Develop principals for high-resolution, intelligent, adaptive imaging of extended source targets embedded in complex images.</li> </ul> <p>Total 3672</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1871 - Test and evaluate the boundary layer model for the stable, nocturnal boundary layer.</li> <li>- Develop robust probability distribution functions of turbulence over non-uniform surfaces to enable accurate and timely predictions of transport and diffusion of chemical agents.</li> <li>• 1951 - Develop a suite of experimental techniques for a state-of-the-art determination of atmospheric contrast transmission for target acquisition.</li> <li>- Determine the effect of limited complex terrain meteorology on atmospheric acoustics.</li> <li>- Develop adaptive control techniques for active imaging using a combined approach based on nonlinear and adaptive optics.</li> </ul> <p>Total 3822</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget</p> <p>Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request</p> <table> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>5177</td> <td>3605</td> <td>3678</td> <td>3777</td> </tr> <tr> <td>5321</td> <td>3530</td> <td></td> <td></td> </tr> <tr> <td>+86</td> <td></td> <td></td> <td></td> </tr> <tr> <td>5407</td> <td>3530</td> <td>3672</td> <td>3822</td> </tr> </tbody> </table>				FY 1996	FY 1997	FY 1998	FY 1999	5177	3605	3678	3777	5321	3530			+86				5407	3530	3672	3822
FY 1996	FY 1997	FY 1998	FY 1999																				
5177	3605	3678	3777																				
5321	3530																						
+86																							
5407	3530	3672	3822																				

Project B53A

Page 62 of 66 Pages

Exhibit R-2 (PE 0601102A)

71

Item 2

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601102A Defense Research Sciences								B74A	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B74A	Human Engineering	2110	2255	2620	2728	2856	2966	3029	3121	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project supports research on soldier performance, including the areas of visual, auditory, cognitive, and stress-related performance. The objective is to identify, describe and manage underlying human-system interface factors critical to the design of Army weapon systems. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Science and Technology Objectives (STOs), and the Army Modernization Plan. All work under this PE is part of the "Human-Systems Interfaces" Tri-Service Reliance Panel.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2110 -Conducted studies addressing human ability to detect, recognize and localize sound sources at various spatial locations in both quiet and noise.</li> <li>-Completed a series of field studies evaluating critical design variables (e.g., field-of-view, ocular configuration, image resolution) affecting the use of night vision devices in military operations.</li> <li>-Conducted studies to examine the relationship between various helmet mounted display options and perceptual fatigue and workload.</li> <li>-Validated noise hazard model for complex waveforms with low frequency components characteristic of armored vehicles and other Army materiel.</li> <li>-Completed development and validation of field practical salivary amylase stress measurement technique; expanded application of procedure to on-going studies of command and control vehicle operations.</li> <li>-Completed a human performance tradeoff analysis of the vision parameters that affect the ability to navigate and drive a teleoperated vehicle.</li> </ul> <p>Total 2110</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2244 -Continue auditory performance studies addressing human ability to maintain a situation awareness of environments containing multiple sound sources and the effect of practice in detecting and localizing sound signals in noise.</li> <li>-Conduct studies to evaluate critical perceptual variables, (e.g., hyperstereopsis) and its effect on the use of night vision devices in military operations.</li> <li>-Validate noise hazard model with hearing loss data and demonstrate with time-varying middle ear muscle system (long acting waveforms) characteristic of enclosed crew compartments.</li> <li>-Conduct studies on the effects of stress on voice recognition system efficacy.</li> <li>-Further define the vision parameters that affect performance in teleoperation, and develop human driving performance model.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 11 2255</p>											
Project B74A		Page 63 of 66 Pages								Exhibit R-2 (PE 0601102A)	

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

PROJECT

B74A

## FY 1998 Planned Program:

- 2620 -Complete report on the effects of spatial separation on the detection and localization of sound signals presented in noise; continue to explore the effects of practice and learning on human auditory performance.
- Continue investigation of hyperstereopsis and its effect on visual perception and depth compression.
- Conduct a helmet mounted display field study examining design tradeoffs in information display format and the relative impact on soldier cross-country navigation performance.
- Continue verification and validation of the noise hazard model with hearing loss data. Demonstrate the previously developed auditory hazard meter in the field for user applications.
- Publish report on the effects of stress on voice recognition system efficacy. Initiate studies on the relationship between stress and complex cognitive functioning.
- Conduct field studies to assess the human driving performance model and compare driving performance under different sensory feedback conditions.

Total 2620

## FY 1999 Planned Program:

- 2728 - Initiate data collection efforts on human auditory processes in detecting sound in various environments and estimating the distance from the sound source.
- Publish results of previous studies examining the interaction effects of field-of-view, ocular configuration, and image resolution on task performance using night vision devices in tactical settings; initiate development of operational metrics for measuring depth perception and visual attention.
- Publish results of previous helmet-mounted display studies and initiate an investigation of the attentional conflicts induced by the use of helmet mounted displays.
- Develop random incidence corrector and calibration procedures for a "general damage" model. Submit impulse noise standards for Committee on Hearing and Bioacoustics (CHABA) review.
- Refine previously developed psychological stress measures and investigate the effects of stress on selected perceptual processes.
- Demonstrate a quantitative methodology for measuring operator performance of teleoperated devices and validate in field studies.

Total 2728

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	2388	2571	2626	2698
Appropriated Value	2454	2255		
Adjustments to Appropriated Value	-344			
FY 1998 Pres Bud Request	2110	2255	2620	2728

Change Summary Explanation: Funding: FY 1996 - Funds reprogrammed (-278) to higher priority requirements.  
FY 1997 - Congressional reduction to basic research activities.

Project B74A

Page 64 of 66 Pages

Exhibit R-2 (PE 0601102A)

73

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 1 - Basic Research

0601102A Defense Research Sciences

PROJECT

B74F

COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
B74F	Personnel Performance and Training	2635	2411	987	997	994	990	987	986	Continuing	Continuing

**A. Mission Description and Justification:** This project conducts behavioral science research in the following areas of human performance: variables and processes determining effective group functioning, leader-group interaction, and decision-making; and principles of technology-based instructional methods that promote the learning of cognitive, perceptual-motor, and unit performance tasks by individuals and groups.

## FY 1996 Accomplishments:

- 2635 -Continued initiative on training research to improve skill retention and transfer of skills relevant to future battlefields.
- Completed research on organizational commitment and continued analysis of new leader behavior.
- Continued research on effects of societal issues on Army morale, cohesion, and retention.

Total 2635

## FY 1997 Planned Program:

- 2352 - Conduct training research on how to improve commander performance. Includes improved thinking and problem solving skills, effective leadership, and communication and control issues in the new, flatter, internetted organizational structures in the digitized battlefield.
- Conduct training research on impact of spatial abilities on performance in simulated environments (e.g., troops get lost more in simulated worlds than in real one).
- Conduct research on the effects of stress, as measured by psychophysiological correlates, on elite performance.
- Analyze effects of peacekeeping service on morale and unit cohesion, and analyze the value of Army service on an individual's future career productivity.
- 59 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2411

## FY 1998 Planned Program:

- 987 -Begin research on skill retention for procedural skills needed in digitized environments.
- Develop methods for long-term skill retention and rapid reacquisition of skills (especially for mobilized reserves).

Total 987

Project B74F

Page 65 of 66 Pages

Exhibit R-2 (PE 0601102A)

Item 2

74

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0601102A Defense Research Sciences

PROJECT

B74F

## 1 - Basic Research

## FY 1999 Planned Program:

- 997 -Continue research on skill retention for procedural skills needed in digitized environments.
- Continue research on methods for long-term skill retention and rapid reacquisition of skills.

Total 997

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

2703

2778

-143

2635

FY 1997

2867

2411

2411

FY 1998

3029

987

FY 1999

3100

997

Change Summary Explanation: Funding: FY 1997 - Congressional reduction to basic research activities.

FY 1998/FY 1999 - Decrease reflects significant restructure of funding for ARI.

Project B74F

Page 66 of 66 Pages

Exhibit R-2 (PE 0601102A)

75

Item 2

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601104A University and Industry Research

Centers

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	46243	44927	45576	52966	55823	58016	59240	61127	Continuing	Continuing
BH50 Telecommunications Research	8259	6710	9160	10143	10626	11044	11279	11546	Continuing	Continuing
BH53 Advanced Distributed Interactive Simulation Research	0	675	729	745	776	804	819	824	Continuing	Continuing
BH54 Advanced Sensors Research	8711	7100	9392	10883	11401	11849	12101	12599	Continuing	Continuing
BH55 Software/Intl Systems Research	974	0	0	0	0	0	0	0	0	974
BH56 Advanced Displays Research	4695	4376	4643	5272	5901	6132	6261	6501	Continuing	Continuing
BH59 University Centers of Excellence	4980	5676	5314	6110	6398	6649	6790	6948	Continuing	Continuing
BH62 Electromechanics and Hypervelocity Physics	9139	9833	8573	10532	11006	11444	11689	12133	Continuing	Continuing
BH64 Materials Center of Excellence	2530	2838	2384	3064	3206	3331	3400	3498	Continuing	Continuing
BH65 Microelectronics Center of Excellence	2430	2838	2492	3063	3206	3332	3400	3497	Continuing	Continuing
BH73 National Automotive Center of Excellence	4525	4881	2889	3154	3303	3431	3501	3581	Continuing	Continuing

**Mission Description and Budget Item Justification:** The Army's initiative to create three open, federated laboratories is an innovative and forward thinking approach focusing the talents of industry and academia on critical technology needs of the Army. The federated laboratory is a partnership between the Army Research Laboratory (ARL) and the private sector involving cooperative agreements, integrated management and staff rotation, education and communication. The basic construct of a federated laboratory is to continue strong in-house involvement to meet Army-unique requirements where there is little external expertise in the technologies, but to forge direct associations with industry/university consortia with recognized competencies in specific technology areas where the centers of expertise are definitely outside of the Government (i.e. telecommunications). Under federated laboratory, ARL formed partnerships with consortia consisting of at least one each of an industrial company, a major university, and a Historically Black College or University/Minority Institution (HBCU/MI). Long-term cooperative agreements (5 years) were established in three key areas,

Page 1 of 25 Pages

Exhibit R-2 (PE 0601104A)

76

Item 3

UNCLASSIFIED

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**RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)**

DATE

**February 1997**

BUDGET ACTIVITY

**1 - Basic Research**

PE NUMBER AND TITLE

**0601104A University and Industry Research  
Centers**

and these consortia have become "virtual labs" within ARL and function like any other ARL division. Research jointly planned and executed and Army scientists and engineers are intermingled through long term assignments with the consortia. The federated laboratory approach for ARL is in accordance with the 1991 Base Realignment and Closure, and the Department of Defense mandate to exploit private sector research and reduce infrastructure. This program element also includes the Army's Centers of Excellence, which are the centerpiece of academic linkage to Army R&D organizations. Centers of Excellence continue to be an integral part of the Army's research investment strategy, along with single investigator programs and Army laboratory research. Centers have proven to be highly effective in many applications-oriented projects, in areas such as rotary wing technology and electronics. Centers couple state-of-the-art research programs with broad-based graduate education programs to increase the supply of scientists and engineers in areas of Army importance. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and DoD Project Reliance. The projects in this PE include basic research efforts directed toward providing fundamental knowledge for the solution of military problems and therefore are correctly placed in Budget Activity 1.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH50	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH50	Telecommunications Research	8259	6710	9160	10143	10626	11044	11279	11546	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project establishes long term collaboration between the Army Research Laboratory and competitively selected industry/university consortia headed by Lockheed Sanders, Nashua, NH, for the purpose of leveraging world class research relevant to Army needs. Battlefield telecommunications involve the reliable, timely, and secure electronic transport of multi-media information over heterogeneous, digital networks exhibiting dynamic topologies. The technical areas addressed under this project are: wireless battlefield digital communications; tactical/strategic interoperability; information distribution; multi-media concepts.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>8259 - Initiated research in wireless battlefield digital communications, tactical/strategic interoperability, information distribution and multimedia concepts.</li> <li>Total 8259</li> </ul> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6546 - Investigate secure, high-capacity multiple access schemes.</li> <li>- Investigate scalable techniques for network self-organization, connectivity tracking, resources allocation, and mobility management.</li> <li>- Develop realistic models for heterogeneous networks.</li> <li>- Develop methods for formal specification and testing of communications, control, and network management.</li> <li>- Investigate techniques for providing data format independence for the organization, maintenance, synchronization, and access of heterogeneous information.</li> <li>- Investigate joint source coding and packet reconstruction techniques for distributing multimedia over corrupted channels.</li> <li>- Develop data compression algorithms with high resolution, low complexity, low latency, and context sensitivity.</li> <li>- Develop efficient algorithms for intermedia and interparticipant multimedia synchronization.</li> <li>164 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> <li>Total 6710</li> </ul>											

Project BH50

Page 3 of 25 Pages

Exhibit R-2 (PE 0601104A)

78

Item 3

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

1 - Basic Research

0601104A University and Industry Research  
Centers

PROJECT

BH50

## FY 1998 Planned Program:

- 9160 -Develop and demonstrate protocols that support seamless connectivity between satellite and terrestrial segments.
- Evaluate the applicability of ATM technology to multi-rate battlefield wireless environments.
- Develop formal testing and validation methodologies for network simulation models.
- Develop and demonstrate an executable-code encoded hybrid network simulation.
- Develop and demonstrate techniques to support push-pull flow control among information servers based on real-time network events.
- Develop and demonstrate scalable multimedia compression techniques which track the rate-distortion curve as the rate is reduced by traffic or bandwidth.

Total 9160

## FY 1999 Planned Program:

- 10143 -Develop and demonstrate alternative signaling protocols for call hand-off, origination, delivery, and internet protocol mobility in a highly mobile environment.
- Develop and demonstrate a network management system based on a next-generation, software-based, fault-tolerant distributed object computing platform and a multi-tier network architecture.
- Demonstrate tactical information distribution technology that incorporates fact-exchange protocols, adaptive flow control and routing, meta data queries, and user-controllable threshold criteria.
- Demonstrate packetization and error recovery methods for multimedia communications over highly corrupted channels.
- Demonstrate intermedia and interparticipant multimedia synchronization using submillisecond time synchronization.

Total 10143

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	8472	9081	10022	10260
Adjustments to Appropriated Value	8710	6710		
FY 1998 Pres Bud Request	-451			
	8259	6710	9160	10143

Change Summary Explanation: Funding: FY 1997-Congressional reduction for Federated Laboratories.

Project BH50

Page 4 of 25 Pages

Exhibit R-2 (PE 0601104A)

79

Item 3

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		DATE		PROJECT						
1 - Basic Research		February 1997		BH53						
PE NUMBER AND TITLE		0601104A University and Industry Research Centers								
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH53 Advanced Distributed Interactive Simulation Research	0	675	729	745	776	804	819	824	Continuing	Continuing

**A. Mission Description and Justification:** The Army Center of Excellence in Information Sciences (ACEIS) at Clark Atlanta University (HBCU/MI) will perform basic (6.1) research in information science within its designated research areas. The research focuses on the mid to far-term needs of information systems for the Army. The program addresses enabling and applied technologies to use new and emerging technologies to meet the needs of a digital force in the 21st Century. It performs research in information science with emphasis in the following areas: interactive and intelligent systems; database and information systems; and distributed and parallel systems. Current research activities align with the Digitization and Communication Sciences Research Program in the software and intelligent systems and the information distribution areas. Work in this project was previously accomplished in PE 0601102A/BH57.

**FY 1996 Accomplishments:** Project not funded in FY 96

**FY 1997 Planned Program:**

- 658 - Develop training Neural Networks for forecasting battlefield weather conditions, logistics distribution problems, and other areas.
- Develop algorithms to study stability properties of communications systems.
- Develop data model tools/techniques for complex systems such as command and control systems.
- 17 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 675

**FY 1998 Planned Program:**

- 729 -Develop test bed for virtual environments.
- Apply intelligent data base capabilities to Army logistics problems.
- Apply parallel processing techniques to tactical command and control.

Total 729

**FY 1999 Planned Program:**

- 745 -Extend virtual environments using neural nets and fuzzy logic. Incorporate advanced data mining techniques into intelligent data base capabilities.
- Investigate technologies for information distribution in a wireless mobile environment.

Total 745

Project BH53

Exhibit R-2 (PE 0601104A)

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601104A University and Industry Research  
Centers

PROJECT

BH53

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

0

FY 1997

690

675

FY 1998

617

FY 1999

702

745

Change Summary Explanation: Funding: FY 1998 -Funding increased (+101) to maintain adequate funding for an HBCU/MI Center of Excellence.

Project BH53

Page 6 of 25 Pages

Exhibit R-2 (PE 0601104A)

81

Item 3

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH54	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH54	Advanced Sensors Research	8711	7100	9392	10883	11401	11849	12101	12599	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project establishes long term collaboration between the Army Research Laboratory and a competitively selected industry/university consortia headed by Lockheed Sanders, Nashua, NH, for the purpose of leveraging world class research relevant to Army needs. Advanced sensors are the elements of systems that view the environment and convert the basic raw sensor data into meaningful information suitable for transmission over tactical networks. The technical areas addressed under this project are: multidomain smart sensors, to include multispectral infrared focal plane arrays; multisensor fusion automatic target recognition algorithms, to include synthesis of sensor modeling; radar sensors, to include atmospheric and terrain effects on propagation; and signal processing, capitalizing on commercially available hardware.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 8711 -Developed integrated program plan with detailed short-term and long-term (3-5 years) goals; developed ARL/consortium work structures supporting workpackages and scientific coordination process; and initiated design based on device application analysis, as well as fabrication of components for Multi-Quantum Well (MQW) detector structure.</li> </ul> <p>Total 8711</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3462 - Complete design of multispectral MQW device; investigate laser radar (LADAR) active imaging concepts, identifying means for integrating laser/detector structures; and determine practical limits of single active/passive imaging system with regard to the extent of spectral bands.</li> <li>• 3464 - Define performance of enhanced performance low-light-level imager (e.g., extended low-wave cut off, and design low-power integrated processing).</li> <li>- Demonstrate signal processing for Multi-Domain Smart Sensors (MDSS) using off chip hardware and selected algorithms.</li> <li>- Deliver baseline Forward Looking Infrared/Synthetic Aperture Radar algorithm and three sensor signature/scene modeling environments.</li> <li>- Evaluate the effectiveness of various target discrimination features for a foliage penetration radar; develop techniques to synthesize clutter data by extrapolating/interpolating from existing millimeter wave clutter data bases.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>174 Total 7100</p>											

Project BH54

Page 7 of 25 Pages

Exhibit R-2 (PE 0601104A)

82

Item 3

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

1 - Basic Research

0601104A University and Industry Research  
Centers

BH54

## FY 1998 Planned Program:

- 9392 -Develop bench demonstration of Multi-Domain Smart Sensor (MDSS), select recognition algorithms for on-chip processing.
- Complete a 3-sensor image processing environment addressing concealment, camouflage and deception (CC&D), obscuration, and articulation.
- Complete selected millimeter wave (MMW) common module sub-assemblies, test low angle tracking algorithms, complete phenomenological description of foliage penetration radar; develop and test feature sets for ground penetrating radar; design wide-band digital beamformer.
- Integrate hybrid optical signal processor/digital signal processor (OSP/DSP) into testbed; demonstrate 10x improvement in size, speed, power; resolve on-chip processing trade-offs for MDSS.
- Complete low-power advanced imaging unattended ground sensor (AIUGS) and define appropriate algorithms.

Total

9392

## FY 1999 Planned Program:

- 10883 -Complete fabrication of large area multi-color focal plane and components for active imaging; implement selected algorithms in integrated circuit structures.
- Complete a 4-sensor image processing environment.
- Deliver a complete set of MMW common modules and integrate into a fully functional testbed configuration; insert upgrades into ARL ultra-wide band (UWB) testbed for use in elevated conditions and conduct foliage penetrations/ground penetration (FOPEN/GPEN) experiments to study algorithm effectiveness.
- Demonstrate hybrid OSP/DSP for specific application; demonstrate 30x improvement in size, speed and power.
- Develop processing hardware for AIUGS; develop network algorithms for target detection and tracking.

Total

10883

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
8935	9758	10755	11163
9187	7100		
-476			
8711	7100	9392	10883

Change Summary Explanation: Funding: FY 1997-Congressional decrease (-2658) for basic research activities.  
FY 1998-Funding reprogrammed (-1363) to higher priority requirements.

Project BH54

Page 8 of 25 Pages

Exhibit R-2 (PE 0601104A)

83

Item 3

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH55	
COST (in Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH55	Software/Intl Systems Research	974	0	0	0	0	0	0	0	0	974
<p><b>A. Mission Description and Justification:</b> This project provides funding for the Army High Performance Computing Research Center (AHPCRC), located at the University of Minnesota. This center addresses research needs in high performance computing (HPC), including advanced algorithms and software technology and evaluation of novel computing environments, and provides for HPC training and the development of human resources. The program includes partners from Clark Atlanta, Florida A&amp;M, Howard, and Jackson State Universities (all Historically Black Colleges and Universities). This includes collaborative research with ARL scientists in the areas of computational fluid dynamics, simulation, advanced manufacturing and materials science, environmental sciences, biotechnology, information technology, and algorithms and software development. The exploitation of emerging scalable computing technology is crucial to the Army, providing timely, accurate modeling and design information to enhance the development of complex, sophisticated weapons systems relying more on computational modeling. Funding for AHPCRC will be provided in PE 0601102A/Project AH48 in FY 1997 and beyond.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>974 - Extended multi-body modeling capability for paratrooper jumping from a tactical aircraft (in collaboration with Natick RDEC).</li> <li>- Demonstrated modeling capability for fluid-structure interaction and the effect of gun component vibration on the firing cycle of the regenerative liquid propellant gun (RLPG).</li> <li>- Demonstrated predictive capability for reacting flows appropriate for hypervelocity flight.</li> <li>- Established capability for porous media flow including adsorption and reaction effects (in collaboration with Corps of Engineers Waterways Experiment Station (CEWES)).</li> </ul> <p>Total 974</p> <p><b>FY 1997 Planned Program:</b> Funded in PE 0601102A/Project AH48.</p> <p><b>FY 1998 Planned Program:</b> Funded in PE 0601102A/Project AH48.</p> <p><b>FY 1999 Planned Program:</b> Funded in PE 0601102A/Project AH48.</p>											

Project BH55

Page 9 of 25 Pages

Exhibit R-2 (PE 0601104A)

84

Item 3

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE			BH55
<b>1 - Basic Research</b>	<b>0601104A University and Industry Research Centers</b>			
<b>B. Project Change Summary</b>				
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	0	0	0	0
Adjustments to Appropriated Value	0			
FY 1998 Pres Bud Request	+974	0	0	0
Change Summary Explanation: Funding: FY 1996 - Project established (+974) to address research needs in high performance computing.				
Project BH55				
Page 10 of 25 Pages				
Exhibit R-2 (PE 0601104A)				

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601104A University and Industry Research  
Centers

PROJECT

BH56

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH56 Advanced Displays Research	4695	4376	4643	5272	5901	6132	6261	6501	Continuing	Continuing

**A. Mission Description and Justification:** This project establishes a competitively selected university/industry consortium headed by Rockwell International Corporation, Cedar Rapids, IA, to provide solutions for the many requirements for information assimilation on the battlefield. Displays and control constructs are the interface between human users and computers. This consortium will develop display subsystem architecture which can provide access to all information of practical use, provide data visualization in an efficient manner and use the advanced hardware and software technologies to address the human sensory modality without overloading the user and degrading performance. Work in this project differs from DARPA's program, which aims to establish a domestic capability for display hardware. The technical areas being addressed under this project are: human-computer interface in an information rich environment; display configuration, real time visualization, architecture, information presentation, and control coupling.

## FY 1996 Accomplishments:

- 4695 -Initiated research in human-computer interface in an information rich environment; initiated research in display configuration. Conducted research involving real time visualization, architecture and information presentation.

Total 4695

## FY 1997 Planned Program:

- 4269 -Demonstrate operational data planning displays; develop algorithms for managing objects in 3-D Battlefield Visualization databases and displays; develop scalable techniques to identify and schedule information for displays that maximize value of information.
- Investigate the techniques for presentation and interaction with terrain and battle-related information on virtual reality displays; develop reliable object alignment systems to resolve registration problems with Augmented Reality.
- Implement design guidelines for development of components to enhance a soldier's ability to understand multiple messages, which increases situational awareness in a minimized time span; develop methods to predict potential enemy courses of action and consequences of tactical options.
- Investigate the architectures for integration of speech, gesture and gaze in display control for hands-free operations.
- Develop principles of multimodal displays and controls.
- Investigate the display stabilization methods and architectures for using display in moving platforms; implement noise cancellation techniques to enhance speech recognition in noisy environments.
- Refine and validate current Display Description Language (DDL) evaluation metrics and develop new multidimensional metrics.
- Develop novel image compression methods specifically tailored for distributed databases with multiple display resolutions.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program.

107

Total 4376

Project BH56

Page 11 of 25 Pages

Exhibit R-2 (PE 0601104A)

86

Item 3

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																				
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																					
1 - Basic Research	0601104A University and Industry Research Centers	BH56																					
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>4643 -Implement a virtual battlefield testbed; implement capabilities supporting visualization of 3-D battlefields, including a prototype system for intelligent information filtering. Integrate architecture with CECOM Digital Integration Lab (DIL).</li> <li>-Develop techniques for assignment of value functions to information objects; develop scheduling algorithms that maximize value and define interface for transport of information to display system.</li> <li>-Implement architectures for integration of speech, gesture and gaze in display control; develop methodology to utilize tactile information; develop prototype components for user-sensitive auditory displays for rapid message understanding and situation awareness.</li> <li>-Demonstrate research results in Advanced Technology Demonstrations (ATDs), Prairie Warrior, Logistics Anchor Desk or Tactical Operations Center (TOC).</li> <li>-Correlate subjective information display metrics with objective display measurements to develop basis for automated display resolution evaluations.</li> <li>-Develop method for determining level of alertness and response to critical visual information; develop principles of virtual displays of combat-related information.</li> </ul> <p>Total 4643</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5272 -Implement visual presentation language; integrate architectures for integration of speech, gesture and gaze in display control; integrate value function techniques into information presentation architectures; integrate value function techniques into information presentation architectures. Continue validation of consortium findings in Army operational environments, including Force XXI; integrate display stabilization methods in Army moving platforms programs such as C2V, MIA1 and M2.</li> <li>-Implement automated display resolution evaluation techniques, scheduling algorithms and assimilation architectures; integrate decision support prediction methodologies into architectures.</li> <li>-Implement principles for development of virtual displays of combat-related information, to facilitate accurate perception and representation of the information; integrate 3-D model based image compression coding system into information presentation and assimilation architecture.</li> </ul> <p>Total 5272</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget</p> <p>Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request</p> <table border="1"> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>4815</td> <td>4735</td> <td>5241</td> <td>5371</td> </tr> <tr> <td>4950</td> <td>4376</td> <td></td> <td></td> </tr> <tr> <td>-255</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4695</td> <td>4376</td> <td>4643</td> <td>5272</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1998- Funding reprogrammed (-598) to higher priority requirements.</p> <p>Project BH56</p> <p>Page 12 of 25 Pages</p> <p>Exhibit R-2 (PE 0601104A)</p>				FY 1996	FY 1997	FY 1998	FY 1999	4815	4735	5241	5371	4950	4376			-255				4695	4376	4643	5272
FY 1996	FY 1997	FY 1998	FY 1999																				
4815	4735	5241	5371																				
4950	4376																						
-255																							
4695	4376	4643	5272																				

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH59	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH59	University Centers of Excellence	4980	5676	5314	6110	6398	6649	6790	6948	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The Army's University Centers of Excellence (COE) provide loci for focused research in areas of strategic importance. Army Centers of Excellence are active in the fields of rotary-wing technology, advanced fuel cell technology, the foundations of image science, and science, mathematics and engineering (SME) education of minority students. The Army's Centers have significant collaborative participation by Historically Black Colleges and Universities/Minority Institutions (HBCU/MIs) and all future Army Centers will be formed in partnership with an HBCU. In addition, industry will be encouraged to "buy into" future Army Centers of Excellence to leverage and synergize the investment in these collaborative efforts.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>2510 - Completed integration of the Rotorcraft Centers of Excellence (RCOE) into the National Rotorcraft Technology Center (NRTC). Awarded new cooperative agreements to Georgia Institute of Technology, Pennsylvania State University and University of Maryland. Initiated program addressing the research topics of efficient low-noise rotors, integrated product and process development including virtual prototyping and advanced distributed simulation, low-vibration dynamic systems, advanced drivetrains, smart and composite structures, day/night adverse weather capability, highly-reliable safe operations and digital-optical integrated flight controls.</li> <li>2470 - Concluded research by the Mathematical Sciences Institute focusing on computational algebra, stochastic analysis and nonlinear wave high resolution simulation.</li> <li>2470 - Developed the scientific foundations of object recognition at Washington University and established metrics for background clutter, image complexity and algorithm performance.</li> <li>- Advanced training technology research at Morris Brown College through research in computer simulation training in cooperation and team performance, and critical decision making.</li> <li>- Established a Center of Excellence for Science, Mathematics, and Engineering (SME) Education at Contra Costa College to strengthen academic programs in SME and attract underrepresented minority students to these programs.</li> </ul> <p>Total 4980</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>3737 - Continue NRTC RCOE cooperative program addressing the research topics of efficient low-noise rotors, integrated product and process development including virtual prototyping and advanced distributed simulation, low-vibration dynamic systems, advanced drivetrains, smart and composite structures, day/night adverse weather capability, highly-reliable safe operations and digital-optical integrated flight controls.</li> </ul>											

Project BH59

Page 13 of 25 Pages

Exhibit R-2 (PE 0601104A)

88

Item 3

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997												
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT													
<b>1 - Basic Research</b>	<b>0601104A University and Industry Research Centers</b>	<b>BH59</b>													
<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Advance image analysis research through investigations of object recognition at Washington University and establish metrics for background clutter, image complexity and algorithm performance.</li> <li>- Advance fuel cell and advanced battery research at the Illinois Institute of Technology with emphasis on lithium-ion/metal oxide and nickel/hydride batteries and direct oxidation methanol fuel cells.</li> <li>- Conclude training technology research at Morris Brown College focused on computer simulation training in cooperation and team performance, and critical decision making.</li> <li>- Support SME education at Contra Costa College to strengthen academic programs in SME and attract underrepresented minority students to these programs.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <table> <tr> <td>•</td> <td>1800</td> <td></td> </tr> <tr> <td>•</td> <td>139</td> <td></td> </tr> <tr> <td>Total</td> <td>5676</td> <td></td> </tr> </table> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2600 - Continue NRTC RCOE cooperative program addressing the research topics of efficient low-noise rotors, integrated product and process development including virtual prototyping and advanced distributed simulation, low-vibration dynamic systems, advanced drivetrains, smart and composite structures, day/night adverse weather capability, highly-reliable safe operations and digital-optical integrated flight controls.</li> <li>- Advance image analysis research at Washington University to develop knowledge and model-based systems, Bayesian models and optimization of fundamental metrics for object recognition.</li> <li>• 2714 - Advance fuel cell and advanced battery research at Illinois Institute of Technology with emphasis on lithium-ion/metal oxide and nickel/hydride batteries and direct oxidation methanol fuel cells.</li> <li>- Support SME education at Contra Costa College to strengthen undergraduate SME academic programs and attract under-represented minority students to these programs.</li> <li>- Establish a multi-disciplinary research program to model human performance to enhance soldier performance on the digitized battlefield.</li> </ul> <table> <tr> <td>Total</td> <td>5314</td> <td></td> </tr> </table> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2800 - Continue NRTC RCOE cooperative program addressing the research topics of efficient low-noise rotors, integrated product and process development including virtual prototyping and advanced distributed simulation, low-vibration dynamic systems, advanced drivetrains, smart and composite structures, day/night adverse weather capability, highly-reliable safe operations and digital-optical integrated flight controls.</li> <li>- Advance image analysis research at Washington University to establish the fundamental limits of the performance of automatic recognition systems.</li> </ul> <p><b>FY 1999 Planned Program: (continued)</b></p> <p>Project BH59</p>				•	1800		•	139		Total	5676		Total	5314	
•	1800														
•	139														
Total	5676														
Total	5314														

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
1 - Basic Research	0601104A University and Industry Research Centers	BH59	
•	3310 - Conclude research on fuel cells and advanced research at the Illinois Institute of Technology. - Support SME education at Contra Costa College to strengthen undergraduate SME academic programs and attract under-represented minority students to these programs. - Continue a multi-disciplinary research program to model human performance to enhance soldier operational effectiveness on the digitized battlefield.		
Total	6110		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	5807	5797	6029
Adjustments to Appropriated Value	5970	5676	
FY 1998 Pres Bud Request	-990		
	4980	5676	5314
			6110
Change Summary Explanation: Funding: FY 1996-Funding reprogrammed (-680) to higher priority requirements; Congressional general reductions and rescissions (-147). FY 1998-Funding reprogrammed (-715) to higher priority requirements.			

Project BH59

Page 15 of 25 Pages

Exhibit R-2 (PE 0601104A)

90

Item 3

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 1 - Basic Research

PE NUMBER AND TITLE

0601104A University and Industry Research  
Centers

PROJECT

BH62

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH62 Electromechanics and Hypervelocity Physics	9139	9833	8573	10532	11006	11444	11689	12133	Continuing	Continuing

**A. Mission Description and Justification:** Tactical demands on the future battlefield will require more mobile and lethal weapons systems having greater range and lethality, and reduced logistical demands to speed deployability and support. Combat vehicles, weapons and other tactical systems must utilize technologies beyond the current state-of-the-art in propellants, materials and electromechanical devices to achieve major technical and operational breakthroughs for future generations of military systems. This project funds a University Affiliated Research Center, the Institute for Advanced Technology (IAT), at the University of Texas. Electromechanics and hypervelocity physics support critical Army research relating to electromechanical systems (EM launchers and power supplies) for applications to electromagnetic (EM) and electrothermal-chemical (ETC) guns. Additionally, this project provides for research, testing and computer modeling of advanced hypervelocity (HV) projectiles. In keeping with the Army Electric Armaments Program strategy, highest emphasis has been placed on advancing the state-of-the-art in pulsed power and on establishing the utility of hypervelocity. The sum of these focused efforts serves as a catalyst for technological innovation and provides crucial support to the Army technology base for advanced weapons systems development with potential applications for anti-armor, artillery and air defense.

## FY 1996 Accomplishments:

- 9139 - Conducted focused experiments on the effects of rail gouging during EM launch; conducted studies of high performance materials in an attempt to identify optimum performance of armature/rail pairs and high dielectric strength insulators; conducted experiments focused on improving launch efficiency; validated EMAP3D code and initiated expansion to include sliding electrical contact interface model; conducted studies to identify and develop improved diagnostics for in-barrel and on-board EM/HV launchers.
- Conducted focused experiments to address the issue of HV utility in the anti-armor role; conducted experiments in HV penetration mechanics and lethality in conjunction with ARL sponsor and Defense Research Agency (UK); conducted studies of HV novel penetrator designs; validated advanced computational codes for modeling HV penetrator structural and aerophysical behavior.
- Planned and conducted the 8th International Electromagnetic Launch Symposium and a Pulsed Power Short Course (expanded and updated) for Army scientists and engineers; continued operating technical information center; hosted high school interns and West Point cadets for summer EM/HV research projects.
- Conducted studies to identify fundamental issues facing pulsed power development and to determine possible solutions; conducted assessments of technological alternatives to rotating machines including integrated pulse forming networks and linear magnetic flux compressors; evaluated high energy density dielectrics for capacitors.

Total 9139

Project BH62

Page 16 of 25 Pages

Exhibit R-2 (PE 0601104A)

91

Item 3

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b>	<b>February 1997</b>
<b>BUDGET ACTIVITY</b>	<b>PE NUMBER AND TITLE</b>	<b>PROJECT</b>	
<b>1 - Basic Research</b>	<b>0601104A University and Industry Research Centers</b>	<b>BH62</b>	
<b>FY 1997 Planned Program:</b>			
9656	<ul style="list-style-type: none"> <li>- Conduct studies and provide critical information on gouging, armature/rail interface interactions, performance of hybrid armatures, high performance materials for EM applications and improved railgun efficiency; conduct integrated launch package modeling and feasibility tests; perform medium scale testing for solid armature designs; validate the updated version of EMAP3D code and add a stress module.</li> <li>- Conduct experiments to demonstrate mass-velocity tradeoff studies of advanced penetrators against reactive targets. Select and perform feasibility demonstrations for most promising novel kinetic energy penetrator designs.</li> <li>- Plan and conduct Electric Gun Theory Short Course (updated and expanded) and Pulse Power II Short Course; continue operating technical information center; continue summer intern and West Point cadet summer research programs, develop materials and conduct peer reviews in preparation for next Electromagnetic Launch (EML) Symposium.</li> <li>- Conduct assessments of critical pulsed power components and systems with emphasis on high speed/high stress performance; work with industry and other research organizations to foster development of the most promising concepts; assess potential of new high temperature super conducting materials for magnetic energy storage in pulsed power applications; assess performance of propellant-driven flux compressors for generation of millisecond high current pulses; evaluate advances in fast-turn-off vacuum and solid state switches.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>		
177			
<b>Total</b>	<b>9833</b>		
<b>FY 1998 Planned Program:</b>			
8573	<ul style="list-style-type: none"> <li>- Conduct tests to obtain critical data on gouging, armature/rail interface interactions, armature performance, launch packages using a sub-scale (medium caliber) EM launcher and to validate the novel models for predicting launch package behavior at or above 2.5 km/sec; use advanced diagnostic techniques developed in previous years to perform non-intrusive measurements required to validate complex models.</li> <li>- Continue to conduct laboratory experiments on sub-scale hypervelocity penetrators of novel configurations to determine their effectiveness against multiple spaced plates, explosive reactive armors and advanced armor materials and configurations; perform sub-scale tests and evaluations/studies which will clearly demonstrate the utility and/or advantages of hypervelocity penetrators as replacements for conventional kinetic energy (KE) and depleted uranium (DU) penetrators.</li> <li>- Plan and conduct Hypervelocity Physics II and Advanced Materials courses; continue to update the data base of the technical information center dedicated to electric gun technologies and hypervelocity physics; expand the summer apprentice and West Point Cadet summer intern projects; conduct a high school out-reach project to encourage young students to pursue careers in science and technology, conduct EML Symposium.</li> <li>- Continue to identify and assess a variety of pulsed power alternatives; recommend the best options for use in an all electric Future Combat System (FCS); assist the Army in working with industry to demonstrate that a practical compact pulsed power system can be mated to an ETC or EM gun; provide the Army with a comprehensive simulation tool for assessing the system efficiency of an integrated electric gun system on a fieldable platform.</li> </ul>		
<b>Total</b>	<b>8573</b>		
<b>Project BH62</b>		<b>Exhibit R-2 (PE 0601104A)</b>	

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE	February 1997	BH62
1 - Basic Research	0601104A University and Industry Research Centers		
<b>FY 1999 Planned Program:</b> <ul style="list-style-type: none"> <li>10532 - Investigate methods to further improve railgun efficiency and barrel life including zoned or laminate/composite rail and barrel concepts, novel launcher configurations, advanced armatures and transition control; conduct experiments to establish a minimum mass launch package and tests to ensure acceptable armature/sabot separation and flight characteristics; begin to consolidate existing validated codes developed for separate parts of the EM launcher into a prototype "virtual railgun" simulation to be used as a tool for designing/developing future railgun systems.</li> <li>- Conduct studies and experiments at near full-scale to optimize the performance of selected KE penetrator concepts against multiple spaced plates, explosive reactive armors advanced armor materials and integrated complex targets; conduct studies to ensure desired flight characteristics at velocities at or above 2.5 km/sec; evaluate designs for EM launch packages and hypervelocity penetrators using models and simulations; further demonstrate the utility of hypervelocity and the benefits of hypervelocity penetrators.</li> <li>- Plan and conduct Advanced Pulsed Power Course II; provide electric armaments community with up-to-date technical reports and information through the facilities at the Technical Information Center; coordinate West Point Cadet summer intern program; expand high school out-reach project.</li> <li>- Study and recommend innovative fabrication concepts, new materials and techniques for improving construction of multi-pole rotating machines to optimize performance; develop output power management techniques to provide maximum system efficiency; continue development and testing of alternative pulse power sources including flux compressors; provide basic test data on new vacuum and solid state switch concepts for electric armaments; conduct studies on advanced test concepts for rotor containment in vehicles under field conditions.</li> </ul>			
Total	10532		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	9734	8443	10397
Adjustments to Appropriated Value	10007	9833	
FY 1998 Pres Bud Request	-868		
	9139	9833	8573
			10532
Change Summary Explanation: Funding: FY 1997- Funding increased by Congress (+1400) for research relating to electromechanical systems. FY 1998- Funding reprogrammed (-1824) to higher priority requirements. FY 1999- Funding reprogrammed (-1221) to higher priority requirements.			
Project BH62		Exhibit R-2 (PE 0601104A)	

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH64	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH64	Materials Center of Excellence	2530	2838	2384	3064	3206	3331	3400	3498	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project promotes long-term collaboration between the ARL Materials Directorate and University/Industry Research Centers for the purpose of conducting world class research and exploiting fundamental breakthroughs in materials science relevant to Army needs. Basic research in materials science and engineering is focused on the Army's armor, armament and soldier protective mission and related Defense Strategic Research Objectives. Collaborative research agreements facilitate a dynamic environment for innovative programs and continuing exchange of scientific talent and equipment needed to achieve long-range research objectives. The project currently emphasizes advanced materials characterization, composite materials, and dendritic polymers research for lightweight, structural armor and armaments; integrated and multifunctional composites; chemical/biological barrier materials and other critical applications.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2530 - Conducted research in corrosion effects and protection of alloys.</li> <li>- Developed interface and high temperature property measurements in metal matrix composites.</li> <li>- Developed non-destructive characterization of polymer matrix composite materials.</li> </ul> <p>Total 2530</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2769 - Continue research in corrosion effects and protection of alloys.</li> <li>- Continue development of interface and high temperature property measurements in metal matrix composites.</li> <li>- Continue to develop non-destructive characterization of polymer matrix composite materials.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 2838</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 684 - Extend technique and transport model to characterize penetrant permeation in multicomponent, block copolymers.</li> <li>- Develop microstructural-based models for matrix-reinforcement interactions and dynamic fracture processes in Metal Matrix Composites (MMCs).</li> <li>- Investigate novel electrochemical techniques and laser-based ultrasonics for deposition and non-destructive characterization (NDC) of thin, protective films.</li> </ul>											

Project BH64

Page 19 of 25 Pages

Exhibit R-2 (PE 0601104A)

94

Item 3

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>1 - Basic Research</b>	<b>0601104A University and Industry Research Centers</b>	<b>BH64</b>																										
<p><b>FY 1998 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>850 -Investigate in-situ bonding between dissimilar polymer materials and inorganic substrates during resin transfer molding (RTM) processing.</li> <li>-Develop atomic-scale models for polymer carbon-fiber interphase formation and microstructure-property prediction.</li> <li>-Investigate constitutive relationships contributing to damage tolerance of thick-section integral armor.</li> <li>850 -Develop molecular models which discriminate dendrimer core vs. surface physical-chemical properties.</li> <li>-Synthesize and investigate structure-property behavior of silicon-containing dendrimers and dendrigraft polymers.</li> <li>-Extend the knowledge base for use of dendrimer as resin modifiers.</li> </ul> <p>Total 2384</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1050 -Develop experimental and theoretical understanding of penetrant transport behavior in smart, selective barrier materials.</li> <li>-Extend nondestructive characterization techniques to assess smart sensor/actuators effects on composite material lifetimes.</li> <li>-Develop diagnostic methods and predictive models for in-situ, real-time monitoring and control of ceramic densification.</li> <li>1014 -Model fiber-resin interphase formation and chemistry/microstructure to dynamics of strength and durability.</li> <li>-Explore novel concepts for enhancing delamination toughness of integrated and 3-D thick-section composites.</li> <li>-Establish fundamental understanding of effects of composite material properties on ballistic performance.</li> <li>1000 -Extend theoretical models to predict molecular dynamics and self-assembling characteristics of dendritic polymers.</li> <li>-Design and synthesize "smart" dendritic polymers and investigate structure-property relationships.</li> <li>-Design, synthesize and assess dendritic polymers which are elastomeric or enhance the barrier properties of elastomers.</li> </ul> <p>Total 3064</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>2903</td> <td>2899</td> <td>2886</td> <td>2877</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2985</td> <td>2838</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-455</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2530</td> <td>2838</td> <td>2384</td> <td>3064</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1996- Funding reprogrammed (-300) to higher priority requirements; Congressional general reductions and rescissions (-73). FY 1998- Funding reprogrammed (-502) to higher priority requirements.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	2903	2899	2886	2877	Adjustments to Appropriated Value	2985	2838			FY 1998 Pres Bud Request	-455					2530	2838	2384	3064
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	2903	2899	2886	2877																								
Adjustments to Appropriated Value	2985	2838																										
FY 1998 Pres Bud Request	-455																											
	2530	2838	2384	3064																								

Project BH64

Page 20 of 25 Pages

Exhibit R-2 (PE 0601104A)

95

Item 3

UNCLASSIFIED



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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
1 - Basic Research		0601104A University and Industry Research Centers								BH65	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH65	Microelectronics Center of Excellence	2430	2838	2492	3063	3206	3332	3400	3497	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The Microelectronics Research Collaborative Program (MCRP) will establish a long term collaboration between ARL Physical Sciences Directorate and universities to ensure a seamless, synergistic cooperative work environment to provide the Army the key technologies and analytical support necessary to assure supremacy in future land warfare. The goals of this effort are to conduct innovative research and exploit new concepts in solid-state physics, electronics engineering and chemical/electrochemical engineering, and provide mutual exchange of public and private sector researchers working at each other's institutions. The technical areas being addressed under this project are: Nanoelectronics/Optoelectronics; Electrochemistry/Energy Science; Biological/Chemical Detection; High Frequency and Quasi-optical Electronics; Piezoelectronics; Microelectromechanics.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2430 - Performed research and development of membranes for methanol fuel cells and investigation of molecular transport mechanisms. Studied the synthesis and process of carbon electrodes for charged storage applications.</li> <li>- Determined selected physical properties of piezoelectric materials to support manufacturing science in acoustic microtechnology. Researched and developed quartz microsensor arrays.</li> <li>- Performed research related to the synthesis and deposition of electroluminescent polymers for high resolution, flat panel display applications.</li> <li>- Studied new concepts and recent advances in microelectromechanical devices, ultra-miniature sensors, actuators, transducers, and microresonators.</li> <li>- Researched materials, optical sources, detectors, waveguides and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology to advance the state of the art in communications and aided-target recognition.</li> </ul> <p>Total 2430</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2769 - Continue research and development of membranes for methanol fuel cells and investigation of molecular transport mechanisms. Study the synthesis and process of carbon electrodes for charged storage applications.</li> <li>- Continue research to determine selected physical properties of piezoelectric materials to support manufacturing science in acoustic microtechnology. Research and develop quartz microsensor arrays.</li> <li>- Perform research related to the synthesis and deposition of electroluminescent polymers for high resolution, flat panel display applications.</li> <li>- Exploit new concepts and advances in microelectromechanical devices, ultra-miniature sensors, actuators, transducers, and microresonators for smart, lightweight, inexpensive battlefield sensors.</li> </ul>											

Project BH65

Page 21 of 25 Pages

Exhibit R-2 (PE 0601104A)

96

Item 3

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

1 - Basic Research

0601104A University and Industry Research  
Centers

BH65

## FY 1997 Planned Program: (continued)

- Research materials, optical sources, detectors, waveguides and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology to advance the state-of-the-art in communications and aided-target recognition.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

69  
Total 2838

## FY 1998 Planned Program:

- 2492 -Perform research in ultra-small/nano-scale electronic/phonic device structures addressing modeling, materials, nanofabrication, characterization, and measurement of performance for high-speed signal processing.
- Investigate heterostructures, materials, optical sources, detectors, waveguides, phase shifters, and optoelectronic integrated circuits for optical signal processing and optoelectronic component technology.
- Study device physics of optoelectronic (OE) devices as well as design, fabrication, radio frequency (RF)/optics integration and optical interconnects.
- Investigate the device physics, fabrication methods, and characterization of electronic and OE devices operating in the millimeter-wave, terahertz, and light-wave domains for radar, communications-on-the-move, and target acquisition.
- Explore new materials, components and fabrication techniques to improve performance, increase safety, and reduce life-cycle costs of high density primary and rechargeable batteries and fuel cells for man-portable applications.
- Conduct fundamental research into new classes of chemical/biological microminiature sensors interfaced with micro-optoelectronic circuitry, multi-toxin sensor arrays, and ultra-sensitive detection materials for miniature, low-cost detectors.

Total 2492

## FY 1999 Planned Program:

- 3063 -Leverage university resources to provide state-of-the art research in microelectronics technology for 21st century Army systems. Areas of interest include nanoelectronics, optoelectronics, photonics, traditional and alternative power sources, piezoelectric materials, wide-band-gap semiconductors, and microelectromechanical devices.
- Continue to provide opportunities for staff rotation, advanced degrees for Army researchers, and a state-of-the-art research environment to ensure Army technological superiority in communications, navigation, and surveillance capability.

Total 3063

Project BH65

Page 22 of 25 Pages

Exhibit R-2 (PE 0601104A)

97

Item 3

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY		PROJECT	
1 - Basic Research		BH65	
PE NUMBER AND TITLE		0601104A University and Industry Research Centers	
		FY 1996	FY 1997
		2903	2899
		2985	2838
		-555	
		2430	2838
			2492
			3063
B. Project Change Summary		FY 1998	FY 1999
FY 1997 President's Budget		2886	2877
Appropriated Value			
Adjustments to Appropriated Value			
FY 1998 Pres Bud Request			
Change Summary Explanation: Funding: FY 1996- Funding reprogrammed (-400) to higher priority requirements; Congressional general reductions and rescissions (-73). FY 1998- Funding reprogrammed (-394) to higher priority requirements.			

Project BH65

Page 23 of 25 Pages

Exhibit R-2 (PE 0601104A)

98

Item 3

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
BH73

## 1 - Basic Research

0601104A University and Industry Research  
Centers

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
BH73 National Automotive Center of Excellence	4525	4881	2889	3154	3303	3431	3501	3581	Continuing	Continuing

**A. Mission Description and Justification:** The Center of Excellence for Automotive Research, established in 1994, is a key element of the basic research module of the National Automotive Center (NAC), located at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC). The Center of Excellence for Automotive Research is an innovative university/industry/government consortium leveraging commercial dual use technology for the Army through on-going and new programs in automotive research, allowing significant cost savings while maximizing technological productivity. The selected university partners include: University of Michigan, University of Iowa, University of Wisconsin, Wayne State University, and Howard University, while key industry partners include the "Big Three" U.S. automotive manufacturers.

**FY 1996 Accomplishments:**

- 4525 -Completed preliminary, unique state-of-the-art powertrain cycle simulation model applicable to both commercial and military vehicles (i.e. dual-need.)
- Finalized expanded network of industrial partners comprising 35 automotive-related companies including the U.S. "Big Three."
- Performed significant analysis optimizations on High Mobility Multi-purpose Wheeled Vehicles and Family of Medium Tactical Vehicles.
- Initiated experimental validation of vehicle simulation models.
- Initiated development of unique dual-need virtual prototyping infrastructure.

Total

4525

**FY 1997 Planned Program:**

- 4761 -Complete initial simulation models related to off-road dual-need vehicle dynamics.
- Develop unique structural analysis techniques related to component performance and reliability.
- Continue experimental validation of vehicle simulation models.
- Continue development of dual-need virtual prototyping infrastructure.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

4881

Project BH73

Page 24 of 25 Pages

Exhibit R-2 (PE 0601104A)

99

Item 3

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>1 - Basic Research</b>	<b>0601104A University and Industry Research Centers</b>	<b>BH73</b>																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2889 -Complete overall vehicle simulation model.</li> <li>-Complete dual-need virtual prototyping infrastructure.</li> <li>-Continue experimental validation of models using state-of-the-art transient prototypes.</li> </ul> <p>Total 2889</p>																												
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3154 -Complete optimization of dual-need overall simulation network.</li> <li>-Complete experimental validation of fully functional system model using advanced hardware prototypes.</li> <li>-Finalize detailed mechanism of effective government, industry and academia partnering and provide recommendations for future relevant tasks.</li> </ul> <p>Total 3154</p>																												
<p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>4848</td> <td>2986</td> <td>3063</td> <td>3143</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>4985</td> <td>4881</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-460</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>4525</td> <td>4881</td> <td>2889</td> <td>3154</td> </tr> </table>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	4848	2986	3063	3143	Adjustments to Appropriated Value	4985	4881			FY 1998 Pres Bud Request	-460					4525	4881	2889	3154
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	4848	2986	3063	3143																								
Adjustments to Appropriated Value	4985	4881																										
FY 1998 Pres Bud Request	-460																											
	4525	4881	2889	3154																								
<p>Change Summary Explanation: Funding: FY 1997- Funding increased by Congress (+1895) for automotive research programs.</p>																												

Project BH73

Page 25 of 25 Pages

Exhibit R-2 (PE 0601104A)

100

Item 3

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602105A Materials Technology								AH84	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH84	Materials	9858	14530	9811	10979	11547	12765	13504	13387	Continuing	Continuing
<p><b>A. Mission Description and Budget Item Justification:</b> This project provides the technical foundation for materials technology in metals, ceramics, polymers, and composites essential for the optimum use of these materials in future Army systems. It also provides the technology base required for solving materials-related problems in existing fielded systems. The project addresses Army specific technologies to increase and sustain survivability and lethality of current and future Army unique systems in individual soldier support equipment, armor, armaments, aircraft, ground and combat vehicles, and combat support. Development efforts are focused in armor/armament materials, as well as lightweight structural materials and materials affording protection against chemical, biological, or directed energy threats. Areas of study in these developments are in characterization, to include high strain rate characterization, processing, and fabrication of these materials. Additional efforts provide materials solutions for improved performance, durability, and cost reduction in Army unique systems. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3600 -Determined dynamic response (constitutive relationships) of ceramic and polymer composite materials for application in ultra lightweight personnel protection.</li> <li>• 4876 -Determined dynamic responses and residual strength properties for emerging composite armor materials applicable to combat and helicopter systems. -Developed analytical tools (modeling, hardware and design data base) for life prediction and deterioration control of polymers in plastics, rubbers, coatings and composite/hybrid materials leading to significant operations and support (O&amp;S) cost reduction. -Developed intelligent imaging systems for non-destructive evaluation (NDE) of materials used in electronic components.</li> <li>• 730 -Investigated wear and erosion effects on current and future gun systems. -Demonstrated performance of thick film, low loss, phase shifter materials at 15 Ghz for high performance, low cost radar antenna applications.</li> <li>• 652 -Characterized near optimal tungsten materials for replacement of depleted uranium in kinetic energy penetrators. - Applied Non-Destructive Evaluation (NDE) methods to characterize flaws and failures in: a) the Composite Armored Vehicle (CAV) hull, and b) multi-layered dielectric materials.</li> <li>- Improved Mission Intensity Counter (MIC) with increased data acquisition rates and state variable modifications.</li> <li>- Completed dynamic model of A-6 landing gear using Dynamic Analysis and Design System (DADS) software.</li> </ul>											
Total		9858									
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4050 -Develop material systems based on a combination of ceramics, intermetallics, composites, and metal hybrids for use in advanced armor systems; investigate alternative warhead materials to replace heavy metal penetrators.</li> </ul>											
Project AH84		Page 1 of 3 Pages								Exhibit R-2 (PE 0602105A)	

Item 4

101

UNCLASSIFIED



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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602105A Materials Technology	AH84	
FY 1997 Planned Program: (continued)			
•	5831	<ul style="list-style-type: none"><li>-Correlate lightweight materials' dynamic properties to improvements in ballistic response for application in ultralightweight personnel protection.</li><li>-Investigate novel approaches to combining low cost titanium and other lightweight materials for incorporation into future armor and Army systems.</li><li>-Demonstrate improved protective coatings, including chemical agent resistant coating (CARC), meeting all military requirements for armament, ammunition, ground support equipment and aircraft.</li><li>-Demonstrate gun tube life enhancement by using protection schemes developed to reduce the attack of advanced propellant systems on conventional and improved gun systems.</li><li>-Combine sensor based manufacturing techniques and on-board life monitoring for use in manufacture of composite components with greater logistic supportability for future armored vehicles.</li><li>-Demonstrate performance of thick film, low loss phase shifter materials for applications at 25 Ghz for an extremely low cost, lightweight radar antenna.</li></ul>	
•	3895	-Develop composite materials for use in ballistic missile structures.	
•	676	- Evaluate, assess, and determine the limits of different NDE methods for use on CAV thick polymer sections and other CAV components.	
		- Develop maneuver recognition software for the MIC using fuzzy logic.	
		- Initiate Cooperative Research and Development Agreement (CRDA) on aircraft brake-induced vibration; model the vibration of constrained layer damped beams with a new viscous higher-order beam theory.	
	78	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.	
Total	14530		
FY 1998 Planned Program:			
•	3325	<ul style="list-style-type: none"><li>-Provide component ferroelectric material for full scale phase shift antenna test to industry. License ferroelectric formulation patents.</li><li>-Produce transparent armor material in a prototype configuration.</li><li>-Develop refractory metal based warhead liners using novel processing.</li><li>-Provide modeling and simulation codes as guidelines to improving the ballistic resistance of ultra lightweight armor material.</li><li>-Provide the Army with reduced signature camouflage CARC paint meeting all low Volatile Organic Compounds (VOC) requirements for tactical and aviation equipment.</li></ul>	
•	5858	<ul style="list-style-type: none"><li>-Evaluate novel processing methods for improved chemical resistance of polymers/elastomers.</li><li>-Develop integral composite structures that combine structural capabilities with ballistic performance without collateral damage.</li><li>-Develop novel armor plate and ballistically tolerant metallic materials using laser processing.</li><li>-Provide guidelines through modeling and simulation codes for enhancing ballistic penetration capabilities of materials.</li><li>-Perform ballistic validation of hybrid (intermetallic) laminate preforms.</li></ul>	

Project AH84

Page 2 of 3 Pages

Exhibit R-2 (PE 0602105A)

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602105A Materials Technology

AH84

## FY 1998 Planned Program: (continued)

- 628 - Develop pattern recognition for acoustic emission (AE) and acousto-ultrasonic measurements for inspecting thick composite structures.
- Apply laser ultrasonic inspection system to flaw detection and characterization; validate smart structure model for estimating changes in elastic coefficients.
- Flight test the MIC; conduct brake-induced vibration tests, and initiate tests of ground vehicle suspension systems.

Total 9811

## FY 1999 Planned Program:

- 5750 - Demonstrate enhanced ballistic performance and dynamic response of ultra lightweight armor materials.
- Demonstrate transparent armor material in a prototype component.
- Demonstrate advanced polymeric/barrier materials that offer improved performance and durability in Army chemical defense applications.
- Develop computer models that determine the structural as well as ballistic performance of complex composite material systems.
- Optimize processing of fabricating ballistically resistant hybrid laminate.
- 4526 - Develop rapid prototyping of ballistically tolerant novel components via laser processing.
- Develop processing techniques for fabrication of nanomaterials for penetrators.
- Produce thick film ferroelectric tape cast specimens for traveling wave antenna.
- Develop rubber bushings and roadwheel materials to enable track systems to extend their service life by 100%.
- 703 - Validate AE and acousto-ultrasonic NDE on CAV.
- Develop 3D finite element analysis for microwave NDE of composites; extend NDE technologies to real time detection of material degradation.
- Investigate active suspension systems for ground vehicles and aircraft, and develop vibration control algorithms.

Total 10979

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

9901

10176

-318

9858

FY 1997

10841

14530

FY 1998

11582

FY 1999

12101

10979

## Change Summary Explanation:

Funding: FY 1997 additional funds appropriated by Congress (+4000) for hardened materials.

FY 1998 funds reprogrammed (-1786) to higher priority requirements.

FY 1999 funds reprogrammed (-1122) to higher priority requirements.

Project AH84

Page 3 of 3 Pages

Exhibit R-2 (PE 0602105A)

103

Item 4

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602120A Sensors and Electronic Survivability

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	26675	19351	19294	19682	19535	20651	20867	21353	Continuing	Continuing
AH15 Ground Combat Identification Technology	3291	3604	3532	3552	3438	3584	3671	3769	Continuing	Continuing
AH16 S3I Technology	16571	13151	12992	13116	13094	13913	14015	14345	Continuing	Continuing
AH25 Nuclear Effects Survivability Technology	4380	0	0	0	0	0	0	0	0	9196
A140 High Power Microwave (HPM) Technology	2433	2596	2770	3014	3003	3154	3181	3239	Continuing	Continuing

**Mission Description and Budget Item Justification:** The objectives of this program are: first, to provide sensor, signal and information processing technology for advanced reconnaissance, intelligence, surveillance, and target acquisition (RISTA), ground to ground and air to ground combat identification (ID), and fire control systems as well as the fuzing and guidance integrated fuzing functions in future munitions and, second, to determine and reduce the susceptibility and vulnerability of Army equipment and systems to nuclear and radio frequency (RF)/high power microwave (HPM) environments. Four critical technologies are addressed to increase the combat effectiveness of tactical Army forces: (1) high power microwave (HPM) technology; (2) combat identification technology; (3) sensors, signatures, signal and information processing (S3I) technology; (4) nuclear effects survivability technology. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Force Modernization Plan and Project Reliance. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602120A Sensors and Electronic Survivability

PROJECT

AH15

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH15 Ground Combat Identification Technology	3291	3604	3532	3552	3438	3584	3671	3769	Continuing	Continuing

**A. Mission Description and Justification:** This program provides the enabling technology necessary to demonstrate advanced combat identification (CI) concepts and systems for all aspects of ground combat. The hardware and software improvements and modeling and simulation advances provided by this project are essential to ensure needed advancements in point-of-engagement target identification (ID) and accurate, timely situational awareness (SA). The operational impact is not only reduced fratricide but also a significant increase in combat effectiveness. CI is also strongly related to the Army's larger objective of battlefield digitization and synergistically supplements that effort by feeding friendly position information from the platform level into the command and control network.

**FY 1996 Accomplishments:**

- 3291 - Developed improved conceptual prototype hardware for combat identification for the dismounted soldier (CIDDS), completed initial technical field testing of prototype approaches, initiated technology down selection process, and provided assistance to Infantry School on requirements definition.
- Conducted initial force-on-force modeling of candidate ground-to-ground and air-to-ground combat ID systems including the dismounted soldier.
- Completed low fidelity initial simulation of air-to-ground CI alternatives, developed virtual simulation of battlefield combat identification system (BCIS) digital data link (DDL), and initiated development of simulation tools for dismounted soldier.

Total 3291

**FY 1997 Planned Program:**

- 3527 - Complete virtual simulation of BCIS DDL, complete constructive modeling of air-to-ground CI systems, and complete initial virtual and constructive simulations of dismounted soldier CI system.
  - Demonstrate prototype CIDDS systems in an operational field experiment sponsored by the Dismounted Battlespace Battle Lab (DBBL) and determine best technical approach for both Land Warrior integrated CIDDS function and stand-alone CIDDS system for other dismounted soldiers.
- Initiate integration into Land Warrior system and transition to engineering and manufacturing development (EMD) for stand-alone system.

77  
Total 3604

**FY 1998 Planned Program:**

- 3532 - Complete integration of CIDDS function into Land Warrior equipment suite and demonstrate as part of Force XXI Land Warrior early user testing under the consolidated Land Warrior program.

Project AH15

Page 2 of 11 Pages

Exhibit R-2 (PE 0602120A)

105

Item 5

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>2 - Applied Research</b>	<b>0602120A Sensors and Electronic Survivability</b>	<b>AH15</b>																										
<p><b>FY 1998 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Analyze and develop target ID concepts for the remaining engagement scenarios for the dismounted soldier, to include soldier-to-vehicle, vehicle-to-soldier and helicopter-to-soldier.</li> <li>- Improve the model fidelity for the chosen CI air, ground and dismounted soldier solutions to support validation of techniques, tactics and procedures (TTPs), create leave-behind training capabilities, and support requirements definition and technology selection for the Land Warrior.</li> </ul> <p>Total 3532</p>																												
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3552 - Complete prototyping and initiate and complete integration of the CI functions for the dismounted soldier, to include soldier-to-vehicle, vehicle-to-soldier and helicopter-to-soldier.</li> <li>- Complete virtual simulation experiments of the complete CI architecture.</li> </ul> <p>Total 3552</p>																												
<p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>3615</td> <td>3686</td> <td>3532</td> <td>3552</td> </tr> <tr> <td>Appropriated Value</td> <td>3615</td> <td>3604</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-324</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>3291</td> <td>3604</td> <td>3532</td> <td>3552</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	3615	3686	3532	3552	Appropriated Value	3615	3604			Adjustments to Appropriated Value	-324				FY 1998 Pres Bud Request	3291	3604	3532	3552
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	3615	3686	3532	3552																								
Appropriated Value	3615	3604																										
Adjustments to Appropriated Value	-324																											
FY 1998 Pres Bud Request	3291	3604	3532	3552																								

Project AH15

Page 3 of 11 Pages

Exhibit R-2 (PE 0602120A)

106

Item 5

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

## 0602120A Sensors and Electronic Survivability

AH16

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	16571	13151	12992	13116	13094	13913	14015	14345	Continuing	Continuing
AH16 S3I Technology										

**A. Mission Description and Justification:** This project provides for the synergistic development of sensors, signal processors, and automatic target recognition (ATR) technology for RISTA, fire control, smart munitions and fuzing systems. In the RISTA and fire control area, the project will develop and demonstrate: (1) advanced ultra wide band (UWB) radar technology for adverse weather, wide-area detection, location and recognition of tactical ground targets concealed in foliage, and buried mines; (2) innovative algorithms for the detection, discrimination, and classification of stationary targets from a low flying helicopter; (3) ATR algorithms that synergistically use outputs of forward looking infrared (FLIR), millimeter wave (MMW) radar and laser radar (LADAR) sensors to identify combat vehicles and perform signature predictions in many bands (infrared, visible, MMW, and LADAR) from targets and backgrounds at specified times, weather conditions and locations; (4) affordable, lightweight target acquisition radar technology for man-portable and battlefield platform applications; (5) advanced optical processing techniques to automatically process, at the sensor, the received signals into target information of sufficiently narrow bandwidth to be compatible with Army communication systems; (6) concept validation of the passive MMW camera. Project goals in the smart munitions and fuzing sensor area include development of advanced microwave, millimeter wave (MMW), acoustic, electrostatic, and LADAR technologies to reliably sense low-cross section targets in high countermeasures and clutter environments. These technologies support the Force XXI modernization efforts, the Army battlefield digitization effort, ATDs/ACTDs such as: Intelligent Minefield; Target Acquisition; Remote Sentry; Rapid Force Project Initiatives; and systems such as: Longbow; advanced submunitions, standoff fuzing for anti-armor munitions, proximity fuzing, range finding for bursting munitions, smart mines, multi-option fuze for artillery; guided and unguided tank, mortar and artillery ammunition; and anti-aircraft applications including projectile and missile fuzing.

## FY 1996 Accomplishments:

- 5833 - Developed refined automatic detection capability for concealed targets using UWB synthetic aperture radar (SAR) data by exploiting unique phenomenology; conducted measurements program on near surface metal and plastic mines using transportable testbed.
- Performed efficient multi-mode waveform processing, using direct digital synthesis and open architecture signal processing; quantified cost savings for future systems.
- Developed advanced target/clutter separation techniques for RISTA and fire control radar applications based on use of neural net and genetic training techniques; evaluated concepts for self-regulating algorithm to sense cluttered background.
- Tested and characterized the ambiguity optical processor and developed algorithms and architecture for the multi-role survivable radar (MRSR) testbed.
- 4446 - Added MMW radar data as the second sensor for ATR algorithms; developed new 10 class model based multi-sensor recognition algorithms; and investigated the performance and data requirement issues related to a SAR/thermal image multi-sensor ATR.
- Developed low cost, enhanced target engagement sensor technologies, including microwave, electrostatic and global positioning system (GPS) for future Army systems; developed design of GPS receiver suitable for projectile firing (very high gravity environment).

Project AH16

Page 4 of 11 Pages

Exhibit R-2 (PE 0602120A)

107

Item 5

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>2 - Applied Research</b>	<b>0602120A Sensors and Electronic Survivability</b>	<b>February 1997</b>	<b>AH16</b>
<b>FY 1996 Accomplishments: (continued)</b>			
	<ul style="list-style-type: none"> <li>- Developed a testbed to quickly analyze acoustic data and facilitate generation of acoustic algorithms and demonstrate real time tracking and identification of targets for application to vehicle, unattended and soldier platforms.</li> <li>- Investigated techniques for providing near-field target signature by purely analytical means; evaluated MMW radar tracking algorithms for armored targets at extended ranges.</li> </ul>		
•	6292	<ul style="list-style-type: none"> <li>- Conducted experiments with Battle Labs to validate the utility of integrating the terrain and environmental reasoning spatial database and tactical event detection and synchronization software.</li> <li>- Completed development and field test of first and second generation modular, concept validation passive MMW camera.</li> </ul>	
Total	16571		
<b>FY 1997 Planned Program:</b>			
•	6490	<ul style="list-style-type: none"> <li>- Provide initial transition of foliage penetration (FOPEN) technology to receiving Research, Development, and Engineering Center (RDEC) by supplying point design for FOPEN radar with supporting algorithms; perform characterization of sub-surface mine signatures.</li> <li>- Implement advanced waveform processing in software and benchmark; evaluate adding advanced moving target indication (MTI) and stationary target indication (STI) algorithms to processor suite.</li> <li>- Test advanced real beam radar target/clutter separation techniques in end-to-end algorithm evaluation facility and provide report; apply data compression techniques to signature storage to enhance vehicle classification capability; test self-regulation concepts on diverse clutter data.</li> <li>- Develop algorithms and architectures for image processing and demonstrate two-dimensional optical processors with high throughput.</li> <li>- Extend performance envelope of the FLIR/MMW model-based algorithm to more difficult scenarios: 10-20 class, moderate to heavy clutter, up to 40% occlusion; initiate development of multi-sensor SAR/thermal images ATR.</li> <li>- Demonstrate GPS performance for projectiles and missiles. Develop LADAR for smart munitions applications.</li> <li>- Expand acoustic real time tracking and identification to include a broader base of ground and air targets.</li> <li>- Develop an initial version of a target signature generator which will accept as user inputs sensor parameters, target description and sensor-to-target geometrics; extend MMW radar track accuracy measurements to armored targets in defilade.</li> <li>- Prototype and evaluate multi-level situational awareness agents that will operate over a distributed computing environment.</li> </ul>	
•	4358		
•	2303		
Total	13151		
<b>FY 1998 Planned Program:</b>			
•	4751	<ul style="list-style-type: none"> <li>- Demonstrate target acquisition and tracking of ground vehicles using 35 Ghz wideband polarimetric testbed.</li> <li>- Report on capability to perform UWB SAR processing steps in real-time on an airborne platform.</li> <li>- Demonstrate stationary target discrimination techniques for real beam radars that increase probability of detection in diverse environments.</li> <li>- Demonstrate two-dimensional imager with on-chip processing in hybrid optical/digital architecture running detection and identification algorithms.</li> </ul>	
•	2369		
Project AH16		Exhibit R-2 (PE 0602120A)	

Page 5 of 11 Pages

108

Item 5

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602120A Sensors and Electronic Survivability

AH16

## FY 1998 Planned Program: (continued)

- 1475 -Extend the operational envelope of SAR ATR approaches to robustly address the full variation of sensor geometrics provided by operational sensors.
- 2867 -Double synthetic scene generation speed while maintaining physical realism.  
-Conduct test firings of GPS tracking of artillery projectiles.  
-Develop acoustic algorithms to track large target formations.  
-Complete brassboard frequency modulated/continuous wave (FM/CW) LADAR with low-cost architecture in an armaments RDEC submunition configuration.
- 1530 -Evaluate and transition multi-level reasoning and situational awareness agents within the battlefield visualization advanced technology demonstration (ATD).  
-Exploit improved processing and algorithms for the real-time transformation of sensor and environmental information into a unified battlefield visualization.

Total 12992

## FY 1999 Planned Program:

- 4685 -Integrate second generation STI algorithms into wideband testbed.  
-Report on performance of UWB SAR algorithms to provide reliable discrimination of mines in clutter.  
-Improve stationary target classification for real beam radars by using adaptively weighted mean square error metrics and efficient multi-resolution template pruning strategies.
- 2342 -Demonstrate smart imager in hybrid optical digital architecture running real-time algorithms on imager data with reduced power requirements.
- 2676 -Demonstrate acoustic target formation tracking.  
-Develop low-cost high resolution three-dimensional radar imaging for munitions.  
-Complete comprehensive testing and analysis of LADAR to demonstrate applicability to ARDEC submunition scenarios.
- 1450 -Perform multi-sensor cross cueing studies between SAR ATR and moving target indicator/electro-optic (MTI/EO) sensors for unmanned aerial vehicle (UAV)-borne multi-sensor SAR payloads.  
-Model urban-type clutter in the visible, infrared and millimeter wave in high resolution synthetic scenes.
- 1963 -Extend software agent concept to include seamless information access over complex heterogeneous multi-databases.  
-Develop prototype to validate real-time transformation of sensor and environmental information with terrain, unit and control to measure battlefield visualization.

Total 13116

Project AH16

Page 6 of 11 Pages

Exhibit R-2 (PE 0602120A)

109

Item 5

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)				DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE			PROJECT
2 - Applied Research		0602120A Sensors and Electronic Survivability			AH16
<b>B. Project Change Summary</b>		FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget		16635	12455	12950	14223
Appropriated Value		17162	13151		
Adjustments to Appropriated Value		-591			
FY 1998 Pres Bud Request		16571	13151	12992	13116

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602120A Sensors and Electronic Survivability

PROJECT

AH25

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH25 Nuclear Effects Survivability Technology	4380	0	0	0	0	0	0	0	0	9196

**A. Mission Description and Justification:** This project develops and provides nuclear weapons effects survivability technology for designing, producing, and fielding tactical systems and equipment for the Army and other military services in accordance with the Tri-Service Reliance Agreements on nuclear weapons effects. The goals are to understand new weapons phenomena and the response of new emerging technologies to nuclear weapons effects, to develop new techniques for mitigating the response of new emerging technologies to nuclear weapons effects, and to develop new methods for analyzing and simulating the effects in order to reduce the costs for achieving nuclear survivability. The analysis tools developed by this project produce the analyses used to support the independent evaluation process for acquisition milestones decisions. This project will provide cost effective solutions for the rapidly growing threat of nuclear weapons technology proliferation in the Third World. This project has been coordinated with the Defense Nuclear Agency and other military services in the DoD Nuclear Technology Area Plan to avoid duplication of effort and maximize return on investment.

## FY 1996 Accomplishments:

- 3123 - Developed test methodologies for radiation survivability of advanced commercial integrated circuits, new static random access memories (SRAMs) and, using the scale model electromagnetic facility, for composite structures.
  - Examined non-linear materials as potential smart composite shield materials and demonstrated composite shielding concept.
  - Calculated radiation shielding effectiveness for a composite armored vehicle and calculated internal blast on massively parallel processing (MPP) computers.
  - Determined non-ideal blast parameters for use in nuclear survivability criteria and specified techniques that will mitigate non-ideal blast effects on personnel and equipment.
- 1257 - Updated working version of nuclear blast codes from experiments and computer analysis design tools.

Total 4380

FY 1997 Planned Program: Project not funded in FY 97.

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

Project AH25

Page 8 of 11 Pages

Exhibit R-2 (PE 0602120A)

111

Item 5

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602120A Sensors and Electronic Survivability	AH25	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	4452	4816	5821
Adjustments to Appropriated Value	4576	0	5908
FY 1998 Pres Bud Request	-196		
	4380	0	0
Change Summary Explanation: Funding: FY 1997-out: Project eliminated. Army will leverage technology from Defense Nuclear Agency.			

Project AH25

Page 9 of 11 Pages

Exhibit R-2 (PE 0602120A)

112

Item 5

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602120A Sensors and Electronic Survivability

PROJECT

A140

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A140 High Power Microwave (HPM) Technology	2433	2596	2770	3014	3003	3154	3181	3239	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is to develop the tools, techniques and methodology to assess the susceptibility and vulnerability of Army equipment and systems to various types of radio frequency (RF)/high power microwave (HPM) environments, and to identify and evaluate the technology required to protect and harden US equipment. This program is coordinated and, when appropriate, leveraged with HPM programs in the Air Force, Navy, Defense Nuclear Agency, National Labs, university consortia and relevant industry and foreign partners.

**FY 1996 Accomplishments:**

- 2433 - Conducted limited HPM susceptibility assessments (through testing and analysis) of foreign and US Army assets including munitions, communications equipment and avionics to support ATDs and ACTDs.
- Conducted HPM hardening technology development and demonstrations centering on completion of microwave/millimeter integrated circuit (MMIC) on-chip limiters for US Army Space and Strategic Defense Command and for selected systems.
- Developed HPM tools (sources/components) for indoor/outdoor experimentation including antennas and pulsed power amplifiers with a focus on development of the wideband klystron amplifier.
- Developed a more rigorous physical foundation for modeling the effects of RF radiation on radar and RF sensor systems.

Total 2433

**FY 1997 Planned Program:**

- 2558 - Model physical phenomena and incorporate into electronic warfare analysis simulation tools for radar and RF sensors.
- Develop electromagnetic susceptibility assessment tools and methods and conduct HPM susceptibility assessments (through experimentation and analyses) of foreign and US Army assets including munitions, communications equipment and avionics to support ATDs and ACTDs.
- Conduct HPM hardening technology development and demonstrations centering on technology to protect US assets on the digital battlefield. Focus will be on silicon carbide (SiC) technology and electro-optics and millimeter wave limiters.
- Develop HPM tools (sources/components) for indoor/outdoor experimentation including antennas and pulsed power amplifiers with a focus on the completion of design for a wideband klystron amplifier for laboratory use. Deliverables will be progress report and journal publication.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 38 2596

Project A140

Page 10 of 11 Pages

Exhibit R-2 (PE 0602120A)

113

Item 5

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																				
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																					
<b>2 - Applied Research</b>	<b>0602120A Sensors and Electronic Survivability</b>	<b>A140</b>																					
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2770 -Develop and enhance current susceptibility tools and measurement methodologies that can be implemented to perform high power radio frequency (HPRF), HPM, and electromagnetic environment (EME) susceptibility assessments on US and foreign assets.</li> <li>-Investigate and characterize new wideband gap semiconductor materials for high-power/high-field applications, specifically focusing on MMIC compatible protection circuits, that will lead to the development and implementation of RF and EM hardened devices for critical systems of the electronic battlefield.</li> <li>-Begin the design of high average power traveling wave tubes and advanced radio frequency-directed energy weapons (RF-DEW) pulsers. Continue design of high average power, broadband klystron components.</li> <li>-Formulate and model first-principle deceptive countermeasure (CM) techniques against anti-radiation missile (ARM) threat.</li> </ul> <p>Total 2770</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3014 -Continue to investigate and characterize new wideband gap semiconductor materials for high-power/high-field applications, specifically focusing on large dynamic range limiters extending into MMW spectrum, that will eventually lead to the development and implementation of RF and EM hardened devices for critical systems on the electronic battlefield.</li> <li>-Study and model generic techniques for mitigating upset of electronic systems and equipment.</li> <li>-Complete a design of high average power broadband klystron amplifier and report on the possibilities for size and weight reduction of continuous wave (CW) broadband klystron amplifiers and begin preliminary design of a high-power ultra wideband source.</li> <li>-Incorporate and validate deceptive CM technique models in ARM simulation environment.</li> </ul> <p>Total 3014</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget Appropriated Value Adjustments to Appropriated Value FY 1998 Pres Bud Request</p> <table> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>2496</td> <td>2651</td> <td>2782</td> <td>2977</td> </tr> <tr> <td>2565</td> <td>2596</td> <td></td> <td></td> </tr> <tr> <td>-132</td> <td>2596</td> <td>2770</td> <td>3014</td> </tr> <tr> <td>2433</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				FY 1996	FY 1997	FY 1998	FY 1999	2496	2651	2782	2977	2565	2596			-132	2596	2770	3014	2433			
FY 1996	FY 1997	FY 1998	FY 1999																				
2496	2651	2782	2977																				
2565	2596																						
-132	2596	2770	3014																				
2433																							

Project A140

Page 11 of 11 Pages

Exhibit R-2 (PE 0602120A)

114

Item 5

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602211A Aviation Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	17853	21898	25982	30281	30249	31911	33020	33737	Continuing	Continuing
A47A Aeronautical and Aircraft Weapons Technology	15340	19213	23110	27152	27132	28605	29712	30374	Continuing	Continuing
A47B Vehicle Propulsion and Structures Technology	2513	2685	2872	3129	3117	3306	3308	3363	Continuing	Continuing

**Mission Description and Budget Item Justification:** The objective of this program element (PE) is to develop aeronautical technology for new and/or upgrades to DoD/Army Vertical Take-off and Landing (VTOL) airborne systems. Helicopter rotors provide low disc loading as compared to the tilt rotor's intermediate disc loading and vertical lift jet engine's high disc loading. Low disc loading VTOL aircraft offer a practical solution to many of the DoD/Army's operational needs. Such aircraft, with their ability to operate below tree top level for Nap-of-the-Earth (NOE) missions, present significantly different analysis and design challenges from traditional fixed wing aircraft which fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, with assistance from National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for US efforts in rotorcraft technology. Technical areas include aeromechanics, aerodynamics, aeroacoustics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment, aircraft system synthesis, aircraft subsystems, advanced helicopter analysis, flight simulation, aircrew-aircraft integration, and aircraft weapons. The work in this PE is consistent with the Department of Defense Technology Area Plans, DoD Joint Warfighter Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and a coordinated, national rotary-wing technology development of rotorcraft), the Army Science and Technology Center (NRTC), a partnership of government, industry and academia, whose primary objective is to ensure the continued superiority of U.S. military rotorcraft systems through focused technology projects with a near term (2-3 year) return on investment, enabling rapid technology insertion into military and commercial rotorcraft. The Army and NASA provide funding which is matched by industry. Army, NASA, Navy, and Federal Aviation Administration (FAA) provide staffing and support for NRTC operations. Projects in this PE include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Work in this PE is performed by contractors including McDonnell Douglas Helicopter Systems, Mesa, AZ; Boeing Helicopter Company, Philadelphia, PA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Northrop Grumman Corp., Bethage, NY; General Electric, Lynn, MA; Allied Signal Engines, Phoenix, AZ; Sikorsky, Stratford, CT; Rolls Royce, Indianapolis, IN; Kaman Aerospace Corp., Bloomfield, CT; Pratt & Whitney, CT; and United Technologies Research Center, CT. Additionally, work in this PE is performed by universities including Arizona State University, AZ; Georgia Institute of Technology, GA; Ohio State University, OH; Penn State University, PA; Purdue University, IN; Texas A&M, TX; University of Southern California, CA; University of Florida, FL; University of Illinois, IL; University of Maryland, MD; University of Michigan, MI; University of Utah, UT; Virginia Polytechnic Institute and State University, VA and Wichita State University, KS.

Exhibit R-2 (PE 0602211A)

Page 1 of 9 Pages

115

Item 6

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b> February 1997
<b>BUDGET ACTIVITY</b>	<b>PE NUMBER AND TITLE</b>	
<b>2 - Applied Research</b>	<b>0602211A Aviation Technology</b>	

Primary in-house developers include Aviation and Troop Command (ATCOM), St. Louis, MO; Aeroflightdynamics Directorate/ATCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate/ATCOM, Ft Eustis, VA; Vehicle Technology Center (VTC) /Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Technology Center/ARL, NASA Lewis Research Center, Cleveland, OH.

This program adheres to Tri-Service Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary) with oversight (the Army is designated the lead DoD agency for rotorcraft technology) and coordination provided by the Joint Directors of Laboratories. Related technology demonstrations are conducted under PE 0603003A (Aviation Advanced Technology). Work in this Program Element contains no unwarranted duplication of effort among the Military Departments. Joint coordination of efforts, where applicable, is conducted with the National Aeronautics and Space Administration (NASA) Low Speed Aircraft Research and Technology; PE 0602122N, Aircraft Technology; and PE 0602201F, Aerospace Flight Dynamics. Coordination to eliminate unnecessary duplication is accomplished by joint program reviews, exchange of program data sheets, research and technology resumes, technical reports; inter-service liaison; attendance at scientific meetings and conferences; participation in the Joint Aeronautical Commander's Group, The Technical Cooperation Program (TTCP), NASA Research and Technology Committees, and the North Atlantic Treaty Organization (NATO) Advisory Group on Aerospace Research and Development (AGARD). Efforts under this PE transition and provide risk reduction for Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). Some efforts also transition to the field through PE 0203752A (Aircraft Engine Component Improvement Program). In addition, this PE's deliverables provide technical support to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement). Active joint Service programs supported: The Tri-Service Integrated High Performance Turbine Engine Technology (IHPTET) program and Navy/Army Joint Advanced Health and Usage Monitoring System (JAHUMS) program. International Cooperative Agreements include Information Exchange on Engine Environmental Protection under the Master Information Exchange Agreement IEA-A-94-UK-1425 titled Advanced Tactical Helicopters and Associated Technology.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602211A Aviation Technology

PROJECT

A47A

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A47A Aeronautical and Aircraft Weapons Technology	15340	19213	23110	27152	27132	28605	29712	30374	Continuing	Continuing

**A. Mission Description and Justification:** The purpose of this project is to conduct exploratory development of technologies for DoD/Army VTOL airborne systems improvements in operational effectiveness and combat mission capability including air-to-ground and air-to-air combat, increased strategic and tactical mobility, improved fire power, increased reliability and reduced maintenance, and increased combat sustainability. Work in this project maintains world excellence in rotorcraft technology through the study of advanced technologies and their applications to rotorcraft. Areas of investigation and research consist of the following: fluid mechanics, dynamics, aerodynamics, advanced flight control technology, handling qualities, aircraft and weapons interaction, acoustics and signature reduction, weight reduction, advanced materials applications, internal/external loads, militarization of propulsion/structures technology, engine specific component technologies in support of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) initiative goal demonstrators, advanced smart materials applications, flight simulation, improved soldier machine integration and pilot-vehicle interface, improvements in reliability and maintainability, combat damage repair of new materials, survivability/vulnerability to new threats, crashworthiness, and logistics. These technologies are being developed for application to current as well as future DoD/Army rotorcraft systems. This project also supports work done under the auspices of the National Rotorcraft Technology Center (NRTC). NRTC addresses five critical path military/civil rotorcraft technology thrusts as follows: (a) process and product improvement for affordability, quality and environmental compliance; (b) enhanced rotorcraft performance; (c) passenger and community acceptance; (d) expanded rotorcraft operations; (e) technologies to support harmonized military qualification. and civil certification.

**FY 1996 Accomplishments:**

- 9943 -Initiated rotorcraft integration analysis of Air to Air weapons and Low Cost Precision Kill (LCPK); updated simulations/models for non-lethal weapons (NLW).
- Completed integrated flight and fire control (IFFC) design for hardware/pilot-in-the-loop simulation/ flight test demonstrations; continued slung load cargo handling qualities development; applied control limiting for cueing to achieve carefree maneuvering; initiated demonstration of full integrated flight and fire control (IFFC) in ground based systems integration facility; initiated integration/checkout of Rotorcraft-Aircrew Systems Concepts Airborne Laboratory (RASCAL) research flight control system; combined innovative rotor technologies and integrated aeromechanics analysis; merged interdisciplinary tools to set design direction for Helicopter Active Control Technology (HACT) demonstration (supports Joint Transport Rotorcraft (JTR) Program).
- Cooperated, under the auspices of the NRTC, with US rotorcraft industry, NASA, Navy, FAA, and academia to reduce manufacturing and operating costs, and evolve critical technologies for exploitation of military and civil rotary-wing applications.
- Initiated a system to measure and control the cure state of a composite laminate; initiated advanced joining technology for fabrication of large, complex structural assemblies in a single cure/ bond cycle; initiated crash dynamics modeling and simulation effort jointly with Army Research Lab (ARL) / Vehicle Structures Directorate (VSD); completed two dynamic impact (drop) tests of crashworthy thermoplastic subfloor sections; completed field evaluation of crashworthy aviator seatback cushions.

Project A47A

Page 3 of 9 Pages

Exhibit R-2 (PE 0602211A)

117

Item 6

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602211A Aviation Technology</b>	<b>A47A</b>	
<p><b>FY 1996 Accomplishments (continued)</b></p> <ul style="list-style-type: none"> <li>5397 -Conducted spin test of low inertia turbine to IHPTET Phase II conditions; completed design of Army/Air Force centrifugal compressor; tested Army/Air Force non-intrusive ignition system, and tested organic matrix composite engine inlet housing; conducted reliability and maintainability sensitivity assessments to identify high priority reliability, maintainability and cost drivers.</li> <li>-Completed program to assess Low Observable (LO) material durability; validated Visual Electro-Optical (VISEO) models.</li> <li>-Continued analysis and concept developments of advanced manned and unmanned VTOL systems, working as teams.</li> <li>-Added model of auditory communications to Man-machine Design and Analysis System (MIDAS), and implemented new user interface and single language simulation.</li> <li>-Provided payment for services from the Defense Finance Accounting System (DFAS).</li> </ul> <p>Total 15340</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>11830 -Continue air-to-air integration studies, LCPK integration concept and investigate integration concepts of NLW for rotorcraft studies.</li> <li>-Provide handling qualities criteria for cargo class rotorcraft slung load night operations; demonstrate carefree maneuvering using control limiting/cueing/applying neural nets; conduct hardware/software design validation for IFFC; complete RASCAL research flight control system checkout and initiate flight simulations; develop critical aeromechanics models for low-cost rotor/fuselage systems.</li> <li>-Demonstrate advanced joining methodologies for scaled composite structures; demonstrate close-loop composite cure process control; develop regime recognition algorithms for structural usage spectrum; initiate effort to demonstrate lightweight, crashworthy landing gear components through the use of metal matrix composite materials; initiate program to demonstrate Z-Pin technology on primary airframe structure; refine crashworthiness simulation codes for Army helicopter application and conduct component-level validation tests.</li> <li>-Conduct engine test of low inertia turbine; fabricate components and assemble into test rig Army/Air Force high pressure ratio centrifugal compressor; demonstrate Army/Air Force non-intrusive ignition system; initiate high performance, light weight turbine module program; initiate efforts in acoustic fault detection and testing of inductive oil monitoring sensors.</li> <li>6465 -Perform an analytical study of advanced visual/EO camouflage effectiveness; initiate program to develop RF transparent rotor blade leading edge erosion protection system; initiate program to develop advanced, light weight, low cost thermal insulation; initiate a program to develop a multi-spectral database of VISEO terrain backgrounds.</li> <li>-Begin comprehensive formal workstation evaluation of MIDAS.</li> <li>-Develop cooperatively, under the auspices of the NRTC, technologies in the areas of low cost and efficient composite structures, reduced manufacturing and operating costs, active flight controls, increased reliability and flight safety, enhanced vehicle performance, noise and vibration reduction, and advanced drivetrain design.</li> <li>-Provide payment for services from the DFAS.</li> </ul> <p>Total 918 19213</p>			
Project A47A		Exhibit R-2 (PE 0602211A)	

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602211A Aviation Technology

A47A

## FY 1998 Planned Program:

- 4629 -Continue NRTC cooperative technology development in low cost and efficient composite structures, metal processing, active flight control and handling qualities, reliability and flight safety, vehicle performance, vibration, acoustic signature, manufacturing and maintenance costs, drivetrains and environmental compliance.
- 7926 -Continue LCPK, NLW and Rotorcraft Air Combat Enhancement (RACE) integration studies; perform coupon tests of advanced multi-spectral pigments, flight test enhanced camouflage coatings; improve crashworthiness codes via modeling and component tests; perform component trade studies for large rotorcraft crashworthiness criteria and component test for acoustic fault detection; continue program to develop advanced, light weight, low cost thermal insulation; initiate fuzzy logic applied diagnostics for sub-systems technology for affordability and sustainability.
- 9637 -Substantiate accuracy of improved algorithms for analysis of data from structural monitoring; initiate program to demonstrate adaptive tooling for complex composite structures; fabricate metal matrix landing gear components; select material and initiate component design for high temperature composites; support fabrication of Z-pin reinforced primary airframe structure; continue structural crash dynamic modeling and simulation effort.
- -Design, fabricate and hover test an on-blade control concept on a model scale rotor in support of the Advanced Rotorcraft Aeromechanics Technology; complete aeronautical design standard on helmet modeled display symbology; complete Beta release of MIDAS to add second generation cognitive models and improvement of execution speed; complete RASCAL flight control system integration and check out; explore advanced tri-service rotorcraft concepts for cargo systems.
- -Design/develop lightweight high efficiency turbine component for IHPTET Phase III; initiate high performance centrifugal compressor design and conduct assessment of advanced gear materials.
- -Provide payment for services from the DFAS.

• 918  
Total 23110

## FY 1999 Planned Program:

- 7076 -Continue NRTC cooperative technology development in the area of active flight controls, and to reduce manufacturing and operating costs, increase reliability and flight safety, and expand rotorcraft operating capabilities.
- 8830 -Continue LCPK, NLW and RACE integration studies; conduct coupon test of advanced multi-spectral pigment/binder systems, fabricate and test subscale IR suppressor concepts; perform structural modeling and full scale crash test of Advanced Composite Airframe Program (ACAP); complete crashworthiness system optimization and design methodology for large rotorcraft; complete algorithm validation and demonstrate detection of impending dynamic mechanical failures; complete analysis of multiple fault systems, establish impact of fuzzy logic methods as a diagnostic tool and initiate development of an advanced full flow debris sensor to monitor oil born debris in lubricated mechanical systems.
- -Conduct test of metal matrix landing gear components; complete detail design and fabricate ballistic tolerant stiffener component using advanced techniques; fabricate high temperature composite component and conduct test; validate composite structural joint methodology; provide validated strength and fatigue life methodologies for rotorcraft composite structures.

Project A47A

Page 5 of 9 Pages

Exhibit R-2 (PE 0602211A)

119

Item 6

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602211A Aviation Technology

PROJECT

A47A

## FY 1999 Planned Program: (continued)

- 10328 -Conduct test of on-blade control concept in forward flight on a Mach-scaled rotor; complete formal evaluation of embedded model accuracy and transition MIDAS to industry through Army/NASA vehicle applications and cooperative research and development agreements; develop stability concepts for external loads and high speed forward flight; flight validate carefree maneuvering concepts in RASCAL; conduct analysis and evaluations on tri-service rotary-wing future system concepts.
- Fabricate and conduct component test of lightweight turbine and complete design and fabrication of centrifugal compressor; initiate composite shaft program and test advanced hot, high hardness gear candidate designs.
- 918 -Provide payment for services from the DFAS.

Total 27152

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	15393	21940	24994	27305
Appropriated Value	15821	19213		
Adjustments to Appropriated Value	-481			
FY 1998 Pres Bud Request	15340	19213	23110	27152

Change Summary Explanation: Funding: FY 1997 - Congressional reduction (-2727).

Project A47A

Page 6 of 9 Pages

Exhibit R-2 (PE 0602211A)

120

Item 6

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602211A Aviation Technology

PROJECT

A47B

	COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A47B Vehicle Propulsion and Structures Technology		2513	2685	2872	3129	3117	3306	3308	3363	Continuing	Continuing

**A. Mission Description and Justification:** The purpose of this project is to conduct exploratory development of generic propulsion and structures technology in support of DoD/Army VTOL airborne systems improvements. Areas of investigation and research include concepts of: small airflow gas turbines; high temperature materials; mechanical drive systems; integrated composites structural integrity; low cost manufacturing concepts; aerodynamic loads; and aeroelastic interactions. The propulsion technology in this project supports the Army Aviation Research, Development and Engineering Center (RDEC) focus on the goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) Program. The goal of IHPTET is to demonstrate technology which would double propulsion system capability for a wide range of potential future aircraft and missile applications.

## FY 1996 Accomplishments:

- 1398 -Completed testing of splintered rotor demonstrating ultra-high pressure ratio (greater than 3:1) from single axial compressor stage.  
-Coupled wave rotor unit with electric heater to simulate engine configuration which is expected to achieve significant increases in power and reductions in fuel consumption; conducted analysis of engine system with wave rotor.
- 1115 -Completed test rig fabrication for demonstration of high temperature magnetic bearing.  
-Tested ARES II system in Transonic Dynamic Tunnel (TDT) calibration laboratory, and initiated redesign to correct deficiencies; completed wind tunnel studies using the tiltrotor model for: 1) a composite tailored wing designed to augment aeroelastic stability, and 2) an active swashplate and flapron for vibration reduction.  
- Prepared the Beechcraft Starship aircraft fuselage for ground vibration test (GVT) and model analysis for future interior noise control evaluations; reduced interior noise data from XV-15 flight test data and compared with initial analytical predictions from NASA acoustics code.  
- Completed parametric studies on frame-to-skin debond strength for bonded fuselage structures; conducted quasi-static indentation tests on graphite missile tubes to obtain damage characterization data and verified results using non-destructive evaluation (NDE) methods; awarded patent on "Method and Apparatus for Thermographically and Quantitatively Analyzing a Structure for Disbonds and/or Inclusions."  
- Validated thermal NDE method for measuring fiber volume fraction; completed redesign analysis of lightweight low cost tiltrotor thin wing; conducted static tests of advanced structural concept for engine/pylon attachment at a tiltrotor wing tip; developed new 2D to 3D transition element for analyzing local thickness effects in composite shell structures.

Total 2513

## FY 1997 Planned Program:

- 1545 -Complete wave rotor warm cycle experimental program and wave rotor/gas turbine engine integration analysis.  
-Complete ceramic matrix composite turbine nozzle hardware fabrication and component testing for IHPTET III.

Project A47B

Page 7 of 9 Pages

121

Exhibit R-2 (PE 0602211A)

Item 6

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602211A Aviation Technology	A47B	
FY 1997 Planned Program: (continued)			
• 1140	<ul style="list-style-type: none"><li>-Complete demonstration of 5:1 compression ratio in two axial stages for use by the Joint Turbine Advanced Gas Generator (JTAGG II).</li><li>-Complete face gear transmission component level experimental and analytical evaluation.</li><li>-Validate engine dynamic model and concepts for active compressor stability enhancement.</li><li>- Participate in Transonic Dynamics Tunnel calibration with equipment design and fabrication, and test section calibration; complete reassign of ARES II platform, fabricate required parts, and conduct bench and hover tests; construct new tiltrotor hover test facility, and conduct initial hover test of the refurbished transmission system on the WRATS tiltrotor model.</li><li>- Determine structural and flight loading requirements for an innovative composite fuselage concept for improved crashworthiness; refine XV-15 exterior acoustic source pressure predictions to improve correlation's with surface pressure measurements; conduct structural dynamic ground vibration tests of a composite aircraft fuselage for model properties and compare with NASTRAN model predictions in preparation for interior noise control studies.</li><li>- Conduct fatigue tests on riveted test coupons to assess crack growth rate and total fatigue life of riveted structures; implement 2D to 3D transition element into advanced shell finite element (FE) code; investigate potential for rapid inspection of composites by combining different NDE technologies through data fusion.</li><li>- Conduct strength and stiffness tests of tailored composite panels and correlate with finite element analysis; fabricate calibrated bond test coupons to investigate adhesive cracking caused by microstructure defects.</li></ul>		
Total	2685		
FY 1998 Planned Program:			
• 1653	<ul style="list-style-type: none"><li>-Complete laser velocimetry mapping of splittered rotor compressor stage.</li><li>-Characterize wave rotor start up process and develop wave rotor operating map.</li><li>-Conduct aero and heat transfer tests at off design conditions for advanced transonic blading.</li><li>-Complete seed fault diagnostic/prognostic spiral bevel gear tests.</li><li>-Demonstrate expert system controller for high temperature magnetic bearing.</li></ul>		
• 1219	<ul style="list-style-type: none"><li>- Determine potential for increasing inherent lag damping in rotorsystems using elastic couplings; Perform aeroelastic tailoring study for soft-inplane tiltrotor design, fabricate a parametrically variable soft-inplane hub for the WRATS tiltrotor model, and perform hover test.</li><li>- Assemble a general purpose active control system for testing generic sets of actuator/controllers and aggressive closed-loop control laws.</li><li>- Fabricate the innovative composite fuselage specimens and verify under simulated crash test conditions that they meet crashworthiness criteria; conduct interior noise control studies of a composite aircraft fuselage.</li><li>- Conduct fatigue tests on structural panels to validate fatigue life and crack growth rates of actual riveted aircraft structures.</li><li>- Develop FE model based on solid-to-shell transition elements for debond analysis of stitched interface.</li><li>- Develop NDE data fusion software using probability based criteria for combining different methods to classify defects; validate durability and damage tolerance models for composite structures; evaluate NDE methods to measure strength of bonded structures.</li></ul>		
Total	2872		
Project A47B		Exhibit R-2 (PE 0602211A)	

Page 8 of 9 Pages

122

Item 6

UNCLASSIFIED



## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602211A Aviation Technology

A47B

## FY 1999 Planned Program:

- 1800 -Couple wave rotor with combustor at engine conditions.  
-Demonstrate readiness of micro, electrical, mechanical systems (MEMS) technology for application to engine components.  
-Complete analysis and performance testing of advanced compressor stage for JTAGG III.  
-Conduct validation tests on thermal behavior of high speed gearing.  
-Conduct high temperature rig testing of magnetic bearing system for JTAGG III.
- 1329 -Complete aeroelastic tiltrotor model test of an aggressive active control system for vibration reductions during simulated maneuvers; initiate fabrication of a new low-noise tiltrotor blade and hub loads versus conventional stiff-inplane hub; validate the scaled innovative composite fuselage concept for improved crashworthiness technology through fabrication and testing of a full-scale prototype fuselage.  
- Validate fracture mechanics models for predicting crack link-up in riveted aircraft structures; validate strength and fatigue life methods for composite structures; develop prototype remote system and specifications to measure bond strength and test on adhesively bonded structures; evaluate NDE data fusion methodology using field measurements.  
- Initiate adaptive architecture methodology to automate 2D to 3D transition in nonlinear structural analysis.

Total 3129

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	2577	2743	2858	3110
Adjustments to Appropriated Value	2649	2685		
FY 1998 Pres Budget	-136			
	2513	2685	2872	3129

Project A47B

Page 9 of 9 Pages

Exhibit R-2 (PE 0602211A)

123

Item 6

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE									
2 - Applied Research		0602270A Electronic Warfare (EW) Technology									
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	14651	15510	16528	18151	18088	18735	19128	19549	Continuing	Continuing
A442	Tactical Electronic Warfare Technology	8907	8599	9155	9957	9922	10275	10489	10724	Continuing	Continuing
A906	Tactical Electronic Warfare Techniques	5744	6911	7373	8194	8166	8460	8639	8825	Continuing	Continuing

**Mission Description and Budget Item Justification:** This program investigates electronic warfare (EW) technologies for current and future systems. The efforts in EW will enable the Army to deny the enemy use of the radio spectrum for command, control, communications and computer intelligence purposes, and provide a decisive advantage to our operational forces against the full range of traditional and non-traditional threat forces. Electronic countermeasures and self protection developments will protect Army forces from a broad range of radio frequency (RF) surveillance/tracking systems and advanced RF/ electro-optical infrared (EOIR) missiles and smart munitions. It also includes development of automated intelligence fusion systems and techniques for managing assets on the battlefield. Work in this program will lead to winning the battlefield information war by controlling the electromagnetic spectrum and conducting successful electronic disruptive/destructive operations inside the enemy decision cycle. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), Science and Technology Objectives (STOs) and the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on electronic warfare. This program includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. It is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications (C3) Technology), PE 0602709A (Night Vision and Electro-Optics Technology), PE 0603789F (C3 Intelligence Technology Development), PE 0603270A (Electronic Warfare Technology), PE 0604270A (Electronic Warfare Development), and PE 0603745A (Tactical Electronic Support Systems - Advanced Development) in accordance with the ongoing Reliance joint planning process. This program is primarily managed by Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

UNCLASSIFIED



## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

## 0602270A Electronic Warfare (EW) Technology

A442

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A442 Tactical Electronic Warfare Technology	8907	8599	9155	9957	9922	10275	10489	10724	Continuing	Continuing

**A. Mission Description and Justification:** This project develops electronic warfare sensor and countermeasure (CM) technologies for self protection of air and ground platforms, area protection against radar-directed weapons (i.e., jamming of enemy counter mortar/counter battery radars), and combat surveillance and target acquisition. The following technology areas are investigated:

- Infrared (IR) countermeasures (IRCM) - technologies that provide air and ground platforms with the capability to detect and jam heat-seeking surface-to-air missiles and anti-tank guided missiles with active IR sources, or to decoy them with flares or other devices.
- Self-protection radar countermeasures/warning - technologies that provide air and ground platforms with warning and jamming against radar-directed air defense weapons, and jamming of top attack/smart munitions/ artillery-delivered radio proximity fuzes.
- Laser warning and countermeasures - technologies that provide air and ground platforms with warning and jamming capability against laser-aided and electro-optically-directed threats including laser range finders, laser designators and laser beamrider missiles.
- Electronic support (ES) - technologies that provide the capability to intercept, direction find, and locate current and emerging hostile non-communications emitters for targeting and tactical situational awareness.
- Area protection radar countermeasures - technologies that provide radar stand-off and stand-in jamming and deception in support of ground forces.

## FY 1996 Accomplishments:

- 3050 - Demonstrated radio frequency (RF) sensor and electronic attack (EA) modulator with capability to locate, deceive and jam monopulse and phased array radars from UHF through millimeter wave; initiated development of low cost finger-printing for signal sorting and combat identification (ID) assistance.
- 3601 - Conducted experiments to pass threat data derived from electronic warfare (EW) self-protection systems to ground vehicles and command posts.
- 2256 - Demonstrated missile warning sensor for low observable (LO) platforms; developed gimbal-less beam steering; developed CM to advanced electro-optic-infrared (EOIR) missiles using advanced special seekers.
- Completed the design of the ES/super high frequency (SHF) receiver and demonstrated the advantages over current receivers.
- Initiated the design of an ES signal processor to provide optimal exploitation of radar signals of interest.
- Initiated fabrication of the omni-directional, high gain, multi-band antenna.
- Continued program for advanced countermeasures against advanced special radar systems.
- Continued efforts to target non-conventional sensors to develop "surgical" countermeasures techniques.

Total 8907

Project A442

Page 2 of 7 Pages

Exhibit R-2 (PE 0602270A)

125

Item 7

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602270A Electronic Warfare (EW) Technology	A442	
FY 1997 Planned Program:			
• 3043	- Continue development of low cost finger-printing signal sorting, jamming and combat ID assistance; initiate EA testing against bistatic, impulse and low probability of intercept radars; initiate RF countermeasures vs. advanced multi-function munitions/weapons that attack both air and ground vehicles.		
• 3327	- Develop fiber optic components to remote aircraft and ground vehicle RF antennas and jamming modules as potential upgrades to current EW systems that will increase warning receiver sensitivity, increase jamming signal to noise ratios, improve reliability, and decrease weight.; initiate development of high direction of arrival accuracy laser warning receiver; and conduct tests against advanced phase array radar.		
• 2161	- Exploit advanced EOIR CM against advanced threat missiles (surface-to-air missiles (SAMs) and anti-tank missiles); techniques will be demonstrated in multi-spectral countermeasures technology demonstration (PE 0603270A/DK16).		
	- Complete the design of the ES signal processor and demonstrate its performance improvements over currently used processors.		
	- Demonstrate the omni-directional, high-gain, multiband antenna with the next generation ES/SHF receiver.		
	- Implement initiative to develop countermeasures to exploit digital radars.		
	- Continue program for advanced countermeasures against advanced special radar systems.		
	- Demonstrate efforts to target non-conventional sensors to develop "surgical" countermeasures techniques.		
• 68	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total	68	8599	
FY 1998 Planned Program:			
• 3087	- Test low cost finger-printing for signal sorting and targeting assist in the Survivability Integration Laboratory (SIL) and link to Ft. Rucker's aviation testbed for user experiment; complete phased array radar digital model to support ECM development.		
• 3780	- Initiate development of multispectral sensor for RF and missile warning as a single module that can form, fit and function replace multiple sensors on aircraft and ground vehicles; complete the tri-service work on the digital advanced special IR missile to support the multispectral countermeasures demonstration.		
• 2288	- Continue laboratory demonstrations for the low probability of intercept (LPI) appliqué receiver and the high speed impulse detector to enable common module electronics intelligence system (CMES) to perform rapid detection, characterization and direction finding of low-power impulse emitters.		
	- Develop test platform for analysis of efforts to ensure compliance with Joint Airborne SIGINT Architecture (JASA) standards.		
	- Develop a simulation tool for the analysis and effectiveness of technology insertion candidate projects.		
	- Initiate countermortar counterbattery radar countermeasures program.		
	- Perform laboratory demonstration of advanced special radar systems countermeasures.		
Total	9155		
Project A442		Exhibit R-2 (PE 0602270A)	
		Page 3 of 7 Pages	

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

2 - Applied Research

0602270A Electronic Warfare (EW) Technology

A442

## FY 1999 Planned Program:

- 3386 - Complete development of the fiber optic remote antenna assembly; integrate into PM-Aviation Electronic Combat (AEC) suite of integrated RF countermeasures testbed for SIL and flight tests. Transition to the Integrated Situation and Countermeasures (ISACM) demonstration.
  - Complete precision UHF/MMW precision direction finding, conduct SIL and flight tests, and transition to ISACM; continue development of jamming techniques against bi-static, low probability of intercept (LPI) and impulse radars.
- 4082 - Continue multispectral RF and laser warning sensor development; initiate jamming effects ECM against integrated multispectral IR missiles, top attack munitions and advanced anti tank guided missiles (ATGMs); complete development of high direction of arrival accuracy laser warning receiver and conduct test.
- 2489 - Conduct laboratory demonstrations for the Multiple Spread Spectrum Subreceiver and the Adaptive Matched Filter Receiver to improve the capability of CMES to detect/characterize modern signals in the presence of a heavy conventional signal environment.
  - Continue development of the JASA compliant test platform.
  - Continue counter mortar counterbattery radar countermeasures effort.
  - Demonstrate the advanced special countermeasures prototype in the field.

Total 9957

## B. Project Change Summary

FY 1997 President's Budget  
 Appropriated Value  
 Adjustments to Appropriated Value  
 FY1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
9023	8783	9078	9498
9274	8599		
-367			
8907	8599	9155	9957

Project A442

Page 4 of 7 Pages

Exhibit R-2 (PE 0602270A)

127

Item 7

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0602270A Electronic Warfare (EW) Technology

PROJECT  
A906

## 2 - Applied Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A906 Tactical Electronic Warfare Techniques	5744	6911	7373	8194	8166	8460	8639	8825	Continuing	Continuing

**A. Mission Description and Justification:** This applied research program involves technologies that provide the capability to intercept, direction find (DF) and locate current and emerging threat communications emitters for targeting, tactical situation awareness, and disruption/destruction of enemy command, control and communications (C3) systems. It specifically develops essential electronic attack (EA) components and techniques for advanced jammers and smaller, low power, lightweight, common modules for advanced systems to counter communications associated with modern threat C3 systems. In addition, it will provide the capability to update through remote means the intelligence and electronic warfare common sensor system (IEWCS) with EA algorithms that allow the system to disrupt, deny or destroy threat communication signals. This effort establishes friendly force ownership of the electromagnetic spectrum. This program also involves fusion (automated assimilation and synthesis) of battlefield intelligence data. It specifically involves development and demonstration of fusion technology to automate manpower intensive command and control information from battlefield sensors, enabling friendly commanders to operate inside of the enemy decision cycle. Resultant enhancements will support joint C3 warfare, by denying threat forces access to their own C3 systems and operating within the decision cycle of threat C3 systems that survive.

## FY 1996 Accomplishments:

- 2650 - Continued fabrication of HF antenna technology demonstrator and transformer utilizing high temperature superconducting (HTSC) materials and test functionality.
- Continued analysis of diverse antenna applications against platform requirements for optimization purposes.
- Completed vulnerability assessment of communication radio systems with several complex communication formats.
- Acquired, analyzed and exploited modern tactical communications systems to develop EA strategies and update IEWCS threat system database.
- 3094 - Completed development of the efficient wideband receiver with the final breadboard configuration of the fast Fourier Transform (FFT) application specific integrated circuit (ASIC) utilizing quadratic residue number system (QRNS).
- Completed development of initial battle damage assessment tools and techniques.
- Completed initial capability for effectively tasking and receiving multi-intelligence sensor data.
- Completed electronic intelligence (ELINT) portion of sensor asset management.
- Completed initial terrain reasoning algorithms.
- - Completed initial prototype of correlation and templating tool.
- Continued development of advanced terrain reasoning algorithms.

Total 5744

Project A906

Page 5 of 7 Pages

Exhibit R-2 (PE 0602270A)

128

Item 7

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602270A Electronic Warfare (EW) Technology

A906

## FY 1997 Planned Program:

- 4200 - Complete testing of HF antenna technology demonstrator and transformer.
- Acquire, analyze and exploit modern tactical communications systems to develop EA strategies and update IEWCS threat system database.
- Complete full military intelligence (MI) sensor asset management tools and techniques.
- Initiate examination of exploitation techniques for advanced communication networks.
- 2711 - Complete tools and techniques for airborne asset management capability.
- Complete prototype of advanced terrain reasoning and generic tools for effectively tasking and receiving multi-intelligence sensor data.
- Continue smart agent tool for effectively tasking and receiving multi-intelligence sensor data.
- Investigate advanced communications jamming techniques to be utilized against evolving threat communications systems.

Total 6911

## FY 1998 Planned Program:

- 3920 - Develop laboratory exploitation techniques against wideband commercial communication signals used for military purposes.
- Demonstrate laboratory exploitation capability against low power advanced communication system.
- Develop and test antenna systems supporting commercial communication exploitation effort.
- Initiate the breadboard development of a field programmable gate array (FPGA)-based signal analysis/attack control system (intended for IEWCS upgrade).
- 3453 - Continue smart agent tools for effectively tasking and receiving multi-intelligence sensor data.
- Continue airborne asset management tools and techniques.
- Continue advanced terrain reasoning tools and techniques and development of SIGINT correlation, templating and associated terrain reasoning tools.
- Execute simulation project to assess incorporating information from airborne survivability equipment with conventional SIGINT assets.
- Begin prediction and assessment tools for electronic attack

Total 7373

## FY 1999 Planned Program:

- 4928 - Port attack algorithms against modern communication signals to the FPGA-based signals analysis control system.
- Initiate countermeasure analysis from a network perspective.
- 3266 - Complete airborne asset management tools and techniques.
- Complete advanced terrain reasoning tools and techniques.
- Continue SIGINT correlation, templating and associated terrain reasoning tools.
- Continue electronic attack assessment and prediction tools

Total 8194

Project A906

Page 6 of 7 Pages

Exhibit R-2 (PE 0602270A)

129

Item 7

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)				DATE	February 1997	PROJECT
BUDGET ACTIVITY						
2 - Applied Research				0602270A Electronic Warfare (EW) Technology		
				PE NUMBER AND TITLE		
B. Project Change Summary				FY 1996	FY 1997	FY 1998
FY 1997 President's Budget				5763	7062	7175
Appropriated Value				6037	6911	8538
Adjustments to Appropriated Value				-293		
FY1998 Pres Bud Request				5744	6911	7373
						8194

Project A906

Page 7 of 7 Pages

Exhibit R-2 (PE 0602270A)

130

Item 7

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602303A Missile Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	17535	29144	21632	24002	24236	25360	26412	26993	Continuing	Continuing
A205 Solid State Dye Lasers	0	3916	0	0	0	0	0	0	0	3916
A214 Missile Technology	17535	25228	21632	24002	24236	25360	26412	26993	Continuing	Continuing

**Mission Description and Budget Item Justification:** This exploratory development program element is designed to provide the Army with missile, rocket, and unmanned vehicle technology ready for insertion into operational systems and next generation weapon systems. Its overall objective is to provide a continental U.S. (CONUS)-based, post-cold-war Army with weapon systems enabling immediate world-wide deployment of forces with the capability to initially contain and ultimately achieve decisive victory against hostile forces equipped with modern weapons. The program element is driven by U. S. Army Training and Doctrine Command (TRADOC) Battle Labs and mission area analyses of deficiencies in the areas of close combat, fire support, air defense, intelligence/electronic warfare, and the priorities set forth in the Army Science and Technology Master Plan. The program element is focused on technologies which enhance weapon system deployability, flexibility, lethality, survivability, and affordability. Work within the program is conducted through system simulation, virtual prototyping, concept synthesis, hardware development, and focused technology demonstrations. The work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0602702E (Tactical Technology), PE 0602602F (Conventional Munitions), PE 0603601F (Conventional Weapons Technology), PE 0601104A (University and Industry Research Centers), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603654A (LOSAT Technology Demonstration), PE 0602782A (C<sup>3</sup> Technology), PE 0605601A (Army Test Ranges and Facilities) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. This program element includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL.

Page 1 of 6 Pages

Exhibit R-2 (PE 0602303A)

131

Item 8

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602303A Missile Technology								A205	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A205	Solid State Dye Lasers	0	3916	0	0	0	0	0	0	0	3916
<p><b>A. Mission Description and Justification:</b> Funds for this program were directed by Congress. This program leverages technologies developed under PE 0602307A/Project A139 Laser Technology. Project A205 provides for the development of dye laser technologies appropriate to future directed energy weapons and the transfer of these technologies to medical applications. This project focuses on developing technologies related to the use of directed energy as a weapon against hardened targets, based on the fact that optical and radio frequency components are inherently vulnerable to laser radiation in their operating bands. Solid state dye lasers provide wavelength agile sources for a variety of military anti-sensor applications as well as the wavelength diversity necessary for medical applications. Technology will be developed for these various applications. The program's objectives center around development of compact, efficient pulsed devices with wavelength diversity and extended service life. This program is closely coordinated with the other services through the Joint Directors of Laboratories (JDL) Reliance Panel on Conventional Weapons. Work is performed by the U.S. Army Missile Command (MICOM) Research, Development, and Engineering Center, Redstone Arsenal, AL. Major contractors include Textron Defense Systems and Palomar Medical Systems.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1500 Develop and characterize solid host laser materials.</li> <li>• 1400 Develop zig-zag laser with objective to demonstrate system operation.</li> <li>• Integrate diffractive optic into zig-zag laser.</li> <li>• Evaluate solid host dye laser materials.</li> <li>• Improve miniature blue laser.</li> <li>• Investigate oscillator/amplifier utilizing solid host material.</li> <li>• 95 Small Business Innovation Research/Small Business Technology Transfer Programs.</li> <li>Total 3916</li> </ul> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p>											

Project A205

Page 2 of 6 Pages

Exhibit R-2 (PE 0602303A)

132

Item 8

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602303A Missile Technology

A205

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	0	0	0
Appropriated Value	0	3916	0	0
Adjustments to Appropriated Value	0	0	0	0
FY 1998 Pres Bud Request	0	3916	0	0

Change Summary Explanation: Funding: FY 1997 - Funds added by Congress.

Project A205

Page 3 of 6 Pages

Exhibit R-2 (PE 0602303A)

133

Item 8

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

## BUDGET ACTIVITY

## 2 - Applied Research

## PE NUMBER AND TITLE

0602303A Missile Technology

## PROJECT

A214

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A214 Missile Technology	17535	25228	21632	24002	24236	25360	26412	26993	Continuing	Continuing

**A. Mission Description and Justification:** Project A214 is focused on missile and rocket technologies that support high fire power/logistic support weight ratio concepts for the early entry forces, to address system concepts that enhance the survivability of launch systems, to provide greater effectiveness under adverse battlefield conditions, to increase kill probabilities against hard targets, and to provide powerful new simulation and virtual prototyping analysis tools. This project encompasses seven major areas: missile guidance systems; air defense target acquisition systems; multi-spectral missile seekers; high fidelity system level simulations; missile aerodynamics and structure; smart, stealthy, smokeless missile propulsion; and focused technology integration/demonstrations. As efforts in these technology areas mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for early entry forces in the Rapid Force Projection Initiative (RFPI), Future Missile Technology Integration (FMTI), and an advanced light weight hypervelocity missile.

## FY 1996 Accomplishments:

- 6197 - Missile guidance systems - Defined guidance and control (G&C) package requirements for the Low Cost Precision Kill 2.75 inch guided rocket and completed preliminary design for two alternative guidance concepts.
- Air defense target acquisition systems - Continued to explore and evaluate integrated air defense fire control target acquisition algorithms and multi-sensor suites. Evaluated active/passive target recognition algorithms.
- Multi-spectral missile seekers - developed missile seeker wide field-of-regard search and hand off techniques compatible with autonomous target acquisition; tested seeker hardware.
- High fidelity system level simulations - developed and demonstrated improved techniques for target signature for hardware-in-the-loop simulation; applied commercial technology to simulation processors and scene generators for low cost solutions.
- 11338 - Missile aerodynamics and structure - validated rotary wing aero-propulsion model; evaluated and selected advanced materials for structural modeling development; completed damage area versus miss distance assessment for warhead guidance fusing techniques to increase capabilities of air defense systems; validated current air target penetration equations for Countering Armor Protection Systems (CAPS) problems.
- Smart, stealthy, smokeless missile propulsion - continued development of smart propulsion componentry technology for application to adaptable, multimission, light weight, survivable systems.
- Focused technology integration/demonstrations - integrated multi-mode airframe technology (MAT) components into a multi-mode airframe for hardware-in-the-loop test; completed conversion and demonstrated advanced optical correlator for use in the infrared (IR) spectrum; completed heavyweight ramburner test of ducted rocket engine for Japan Cooperative Program.

Total 17535

Project A214

Page 4 of 6 Pages

Exhibit R-2 (PE 0602303A)

134

Item 8

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

2 - Applied Research

0602303A Missile Technology

A214

## FY 1997 Planned Program:

- 9628 - Missile guidance systems - demonstrate low cost, low weight/volume guidance and control package for insertion into DoD missile systems; demonstrate software for advanced operating system and develop software reuse approaches.
- Air defense target acquisition systems - demonstrate advanced integrated air defense fire control target acquisition algorithms and multi-sensor suites; test active/passive target recognition algorithms in operational scenarios; evaluate automatic target recognition algorithms for integrated missile systems.
- Multi-spectral missile seekers - demonstrate missile seeker search and hand-off techniques applicable to autonomous target acquisition.
- High fidelity system level simulations - develop improved radio frequency signal modulators; upgrade target signature and scene generator control software to accommodate improved generation techniques; evaluate infrared scene projectors.
- Missile aerodynamics and structure - implement modeling codes for aerodynamic, structural, warhead fusing, and missile concept evaluation; complete integration of CAPS long standoff warheads into missile testbed and test; test advanced composites.
- 10667 - Smart, stealthy, smokeless missile propulsion - demonstrate and test advanced propulsion concepts such as ducted rocket engines, air turbo rockets, advanced solid propulsion, gel motors, and hybrid concepts.
- Focused technology integration/demonstrations - execute MAT flight demonstration; conduct ground testing of lightweight ducted rocket engine demonstration for Japan Cooperative Program.
- 4933 - Conduct compact kinetic energy missile (CKEM) technology demonstration concept definition, missile subsystem trades, and initial critical demonstrations in propulsion and guidance and control.
- Demonstrate the ability of novel kinetic energy penetrators to defeat future explosive reactive armor technology anticipated for fielding in the 2010-2015 time frame on advanced threat tanks.

Total

25228

## FY 1998 Planned Program:

- 10367 - Missile guidance systems - Demonstrate through a captive field test seeker/sensors, inertial instrumentation, controller characterizations, and launcher platform integration technologies for a low cost accurate control package for the 2.75" rocket, that will provide reduced cost per kill, minimized collateral damage and greatly increased number of stowed kills over the present fielded system. Complete IR polarimetry demonstrations. Develop fly-over-shoot-down imaging tracking algorithms.
- High fidelity system level simulations - Apply computational electromagnetic methods to the prediction of ground target vehicle signatures at millimeter radar frequencies, and develop improved methods of estimating air and ground target infrared signatures for hardware-in-the-loop.
- Missile aerodynamics and structure - Complete craft computational fluid dynamics development, complete grid fin methodology and data base. Design hypervelocity missile structures; demonstrate feasibility of composite airframes and structures.
- 11265 - Smart, stealthy, smokeless missile propulsion - Develop reduced combustor length ducted rocket engine, flight test low cost boost/sustain turbojet, develop advanced oxidizer fuel gels for long range, survivable, multi-mission capabilities which reduce assets required.

Project A214

Page 5 of 6 Pages

Exhibit R-2 (PE 0602303A)

135

Item 8

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602303A Missile Technology</b>	<b>A214</b>	
<b>FY 1998 Planned Program: (continued)</b>			
<ul style="list-style-type: none"> <li>- Focused technology integration/demonstrations - Demonstrate a motor and propulsion concept of the compact kinetic energy missile technology. Conduct assessment and analysis of new missile technologies.</li> </ul>			
Total	21632		
<b>FY 1999 Planned Program:</b>			
<ul style="list-style-type: none"> <li>• 11502 - Missile guidance systems - Complete signature tests for difficult targets and masked helicopters, assess tracker, automatic target recognition, and non-cooperative target recognition on wide spectrum realistic data sets and targets, which will develop acquisition technologies for defeating classes of targets which are difficult or impossible to defeat presently.</li> <li>- High fidelity system level simulations - Develop improved techniques for calculating simulation scenario background clutter for millimeter wave radar and infrared wavebands. Initiate signature model validation for these wavebands based on comparison of measured and predicted signature results.</li> <li>- Missile aerodynamics and structure - Perform control fin wind tunnel test. Fabricate, assemble, and test the design and integration of high performance electronics into small diameter missile assemblies; demonstrate advanced damping systems to protect sensitive sensors/electronics from hypervelocity shock and vibration.</li> <li>• 12500 - Smart, stealthy, smokeless missile propulsion - Demonstrate high performance, minimum signature solid propulsion, complete actuator and control integration and demonstrate pintle, and develop gel flightweight component - for long range, survivable, multi-mission capabilities which reduce assets required.</li> <li>- Focused technology integration/demonstrations - Conduct a flight demonstration of the compact hypervelocity missile technology. Conduct assessment and analysis of new missile technologies.</li> </ul>			
Total	24002		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	17500	20295	23320
Adjustments to Appropriated Value	17985	25228	
FY 1998 Pres Bud Request	-450		
	17535	25228	21632
			24002
Change Summary Explanation: Funding: FY 1997- Funding increased by Congress (+4933) for compact kinetic energy missile technology demonstration.			

Project A214

Page 6 of 6 Pages

Exhibit R-2 (PE 0602303A)

136

Item 8

UNCLASSIFIED



## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

## BUDGET ACTIVITY

## PE NUMBER AND TITLE

## 2 - Applied Research

## 0602308A Modeling and Simulation Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	19466	20652	21059	24287	27512	26070	19284	20895	Continuing	Continuing
AC90 Distributed Interactive Simulation (DIS) Technology	7662	9298	9995	10849	10827	11210	11439	11706	Continuing	Continuing
AC99 Advanced Concepts & Technology II (ACT II)	11804	11354	11064	13438	16685	14860	7845	9189	Continuing	Continuing

**Mission Description and Budget Item Justification:** Work in this program element (PE) advances development and use of modeling and simulation, including distributed interactive simulation (DIS), related to Army-specific experiments/demonstrations and industry participation at the U. S. Army Training and Doctrine Command (TRADOC) Battle Labs and the Army's Force XXI. It develops standards, architecture and interfaces essential to realizing the DoD/Army vision of creating a verified, validated and accredited synthetic "electronic battlefield" environment. The electronic battlefield is used to investigate and demonstrate new warfighting concepts including development of tactics, doctrine, training techniques, soldier support, systems and system upgrades. It directs and stimulates advances in those technologies required for real time interactive linking within and among constructive, virtual and live simulations. Work also supports planning and execution of the Advanced Concepts and Technology (ACT) II program, which demonstrates mature technologies for the Army's Battle Labs. ACT II provides a timely, low overhead mechanism for industry and academia to participate in the Army's Force XXI and TRADOC Battle Labs' warfighting demonstrations and experiments. Work is consistent with the Army Science and Technology Master Plan and the Army Modernization Plan. Efforts include non-system specific development efforts directed at specific military needs and are correctly placed in Budget Activity 2.

Work is performed by the broadest range of the nation's industrial and academic communities. Contractors include: Natural Selection, La Jolla, CA; Morris Brown College, Atlanta, GA; Acusoft, Orlando, FL; Pathfinder Systems, Lakewood, CO; University of Central Florida, Institute for Simulation and Training, Orlando, FL; Veda Incorporated, Orlando, FL; Perceptronics, Inc., Woodland Hills, CA; Lockheed Martin, Orlando, FL. Simulation, Training and Instrumentation Command (STRICOM), Orlando, FL, is responsible for Project AC90 and Army Research Office, Raleigh, NC, is responsible for Project AC99. Efforts for ACT II are being performed by the following contractors: Center for Photonics Research, Boston, MA; Chain Reactions, Inc., Gold River, CA; FFE International, Inc., Alexandria, VA; General Dynamics Land Systems, Tallahassee, FL; Harris Corporation, Rochester, NY; Hughes Missile Systems Company, Tucson, AZ; Lockheed Martin Electro-Optical Systems, Inc., Pomona, CA; Lockheed Martin Vought Systems Corporation, Dallas, TX; Lucent Technologies, Inc., McLeansville, NC; McDonnell Douglas Aerospace, Huntsville, AL; McDonnell Douglas Aerospace, Huntsville, AL; McDonnell Douglas Aerospace, Huntington Beach, CA; Mobile Datacom Corporation, Clarksburg, MD; Monterey Bay Corporation, Columbia, MD; Morris Brown College, CERT, Atlanta, GA; Mystech Associates, Falls Church, VA; Northrop Grumman Corporation, Baltimore, MD; Research Triangle Institute, Research Triangle Park, NC; Rolands & Associates Corporation, Monterey, CA; Syracuse Research Corporation, Syracuse, NY.

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<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE <b>0602308A Modeling and Simulation Technology</b>	
<p>Future efforts will be performed by a broad range of contractors selected in response to the Broad Agency Announcement (BAA) process. This program is fully coordinated with the other Army exploratory development programs, Defense Advanced Research Projects Agency (DARPA), Defense Modeling and Simulation Office, TRADOC and DoD Project Reliance agreements on conventional air/surface weaponry, with oversight provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with efforts in PE 0604715A (Non-System Training Devices - Engineering Development). There is no duplication of effort within the Army or Department of Defense.</p>		

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

## 0602308A Modeling and Simulation Technology

AC90

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AC90 Distributed Interactive Simulation (DIS) Technology	7662	9298	9995	10849	10827	11210	11439	11706	Continuing	Continuing

**A. Mission Description and Justification:** This program provides and demonstrates enabling technologies for advancing distributed interactive simulation (DIS) and high level architecture (HLA) in a synthetic environment necessary to support the Army's goal of exploiting modeling and simulation technology as a significant acquisition and training tool. Synthetic environments with virtual combined arms battlefield representation will permit evaluation of new system concepts, tactics and doctrine and test requirements with a warfighter-in-the-loop throughout the acquisition life cycle, reducing both cost and time incurred by the traditional approach. Focus areas include computer generated forces (CGF), simulation interface and linkage technologies, and complex data modeling and interchange.

**FY 1996 Accomplishments:**

- 3217 - Provided high level architecture prototype demonstrations of emerging "object model templates" and simulation support tools for pre, post and run time and continued to develop authoritative computer generated forces representations of humans and human behavior for individuals and groups including verification, validation and accreditation (VV&A).
- 2390 - Established a multi-site, distributed laboratory of networked virtual reality devices for integration of individual warriors into synthetic environments.
- 2055 - Defined methods and approaches for determining multi-cast grouping strategies for distributed systems required for linking interactively among all classes of simulation.

Total 7662

**FY 1997 Planned Program:**

- 781 - Demonstrate increased realism in intelligent operational forces (OPFOR) modeling; develop algorithms for configurable CGF behavioral modeling.
- 1800 - Demonstrate an initial capability to provide individual combatant mobility and interaction in the synthetic environment.
- 2500 - Establish inter-vehicle embedded simulation technology (INVEST) demonstrating a crew proficiency application with a Bradley Fighting Vehicle (BFV) trainer, including canned simulation scenario, image generator, vehicle driver display, virtual target injection and burst on/burst off target effects; assess tasks and skills to determine which are most appropriate for embedding; develop and deliver feasibility analysis study for embedded simulations; convert training objectives into embedded simulation goals.
- 3990 - Develop and enhance the synthetic environment to support a division-sized battlefield; develop and evaluate open object-oriented architecture, including methods for model definition and VV&A of networked simulations; continue development/testing of standards, expand terrain data base work, and evolve/refine data collection and analysis.
- 227 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- 9298

Total

Project AC90

Page 3 of 6 Pages

Exhibit R-2 (PE 0602308A)

139

Item 9

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY																												
2 - Applied Research		0602308A Modeling and Simulation Technology	AC90																									
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>791 - Transition semi-automated force (SAF) voice input/output technology; improve real C4I interfaces to CGF for varying echelons.</li> <li>1802 - Provide a demonstrated capability to fully immerse the live combatant in the synthetic environment, to include control of semi-automated forces through voice and gesture recognition.</li> <li>2500 - Prototype embedded simulation modular hardware and software components; prototype virtual-live interactive system; demonstrate unit proficiency application with the BFV simulator.</li> <li>4902 - Develop and enhance the synthetic environment to support a corps-sized battlefield; develop and evaluate open object-oriented architecture, including methods for model definition and VV&amp;A of networked simulations; continue development/testing of standards, expand terrain database work, and evolve/refine data collection and analysis.</li> </ul> <p>Total 9995</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>849 - Develop CGF capability for variable model fidelity; implement multi-resolution technology for full-force CGF implementation.</li> <li>2500 - Demonstrate mission specific application, including rapid scenario facility and mission-specific training in a networked environment, with BFV trainer; demonstrate vehicle-on-the-move (VOM) application with BFV prototype vehicle.</li> <li>4200 - Develop and enhance the synthetic environment to support an echelon above corps (EAC)-sized battlefield; develop and evaluate open object-oriented architecture, including methods for model definition and VV&amp;A of networked simulations.</li> <li>3300 - Continue standards development/testing, expand terrain data base work, and evolve/refine data collection and analysis.</li> </ul> <p>Total 10849</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget Appropriated Value Adjustments to Appropriated Value FY 1998 Pres Bud Request</p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td></td> <td>7859</td> <td>9516</td> <td>10121</td> <td>10416</td> </tr> <tr> <td></td> <td>7859</td> <td>9298</td> <td></td> <td></td> </tr> <tr> <td></td> <td>-197</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>7662</td> <td>9298</td> <td>9995</td> <td>10849</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999		7859	9516	10121	10416		7859	9298				-197					7662	9298	9995	10849
	FY 1996	FY 1997	FY 1998	FY 1999																								
	7859	9516	10121	10416																								
	7859	9298																										
	-197																											
	7662	9298	9995	10849																								

Project AC90

Page 4 of 6 Pages

Exhibit R-2 (PE 0602308A)

140

Item 9

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

## 0602308A Modeling and Simulation Technology

AC99

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AC99 Advanced Concepts & Technology II (ACT II)	11804	11354	11064	13438	16685	14860	7845	9189	Continuing	Continuing

**A. Mission Description and Justification:** Advanced Concepts and Technology II (ACT II) uses a yearly Broad Agency Announcement (BAA) to industry and academia, and provides a low-overhead, timely mechanism for the demonstration of mature, commercial-off-the-shelf (COTS) technologies, prototypes, software, and/or systems for assessment by the TRADOC Battle Labs. It evaluates new concepts through soldier-in-the-loop constructive and virtual simulations, electronic battlefield demonstrations and field tests, and modeling and simulation in real time. Specific areas of interest include: battlespace management and battlefield synchronization, depth and simultaneous attack capabilities, early entry operations, lethality, survivability and mobility; command, control, communications and computers (to include interoperability); force sustainment; and doctrine and leader development. All projects support and complement the Army computer technical architecture tenets. The ACT II goal is to advance a need from concept to demonstration to the soldier in one year.

## FY 1996 Accomplishments:

- 11804 - Conducted demonstrations and experiments in support of Battle Labs.
- This effort includes the following activities:
  - (1) Released BAA to solicit Battle Lab-related concepts and technologies from the nation's industrial and academic communities.
  - (2) Awarded/initiated 25 ACT II projects which will provide high payoff and innovative efforts for demonstration of warfighting capabilities.
  - (3) Analyzed and evaluated the results of FY 1995 efforts; identified candidates for streamlined acquisitions.

Total

11804

## FY 1997 Planned Program:

- 11076 - Conduct demonstrations and experiments in support of Battle Labs.
- This effort includes the following activities:
  - (1) Release BAA to solicit Battle Lab-related concepts and technologies from the nation's industrial and academic communities.
  - (2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.
  - (3) Award/initiate 20 ACT II projects which will provide high payoff and innovative efforts for demonstration of warfighting capabilities.
  - (4) Analyze and evaluate the results of FY 1996 efforts; identify candidates for streamlined acquisitions.
  - (5) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.

• 278

Total

11354

Project AC99

Page 5 of 6 Pages

Exhibit R-2 (PE 0602308A)

141

Item 9

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY																												
2 - Applied Research		February 1997	AC99																									
PE NUMBER AND TITLE		0602308A Modeling and Simulation Technology																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 11064 - Conduct demonstrations and experiments in support of Battle Labs.</li> <li>• - This effort includes the following activities:               <ul style="list-style-type: none"> <li>(1) Release BAA to solicit Battle Lab-related concepts and technologies from the nation's industrial and academic communities.</li> <li>(2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.</li> <li>(3) Analyze and evaluate the results of FY 1997 efforts; identify candidates for streamlined acquisitions.</li> <li>(4) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.</li> </ul> </li> </ul> <p>Total 11064</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 13438 - Conduct demonstrations and experiments in support of Battle Labs.</li> <li>• - This effort includes the following activities:               <ul style="list-style-type: none"> <li>(1) Release BAA to solicit Battle Lab-related concepts and technologies from the nation's industrial and academic communities.</li> <li>(2) Select, within resource constraints, high payoff and innovative efforts for demonstration of warfighting capabilities.</li> <li>(3) Analyze and evaluate the results of FY 1998 efforts; identify candidates for streamlined acquisitions.</li> <li>(4) Approve BAA topics for new ACT II projects to satisfy future Army and DoD needs not being addressed by existing programs.</li> </ul> </li> </ul> <p>Total 13438</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>12108</td> <td>11618</td> <td>19436</td> <td>24110</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>12447</td> <td>11354</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-643</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>11804</td> <td>11354</td> <td>11064</td> <td>13438</td> </tr> </table> <p>Change Summary Explanation:        Funding: FY 1998 Funds reprogrammed (-8372) to higher priority requirements.        FY 1999 Funds reprogrammed (-10672) to higher priority requirements.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	12108	11618	19436	24110	Adjustments to Appropriated Value	12447	11354			FY 1998 Pres Bud Request	-643					11804	11354	11064	13438
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	12108	11618	19436	24110																								
Adjustments to Appropriated Value	12447	11354																										
FY 1998 Pres Bud Request	-643																											
	11804	11354	11064	13438																								

Project AC99

Page 6 of 6 Pages

Exhibit R-2 (PE 0602308A)

142

Item 9

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

## BUDGET ACTIVITY

## 2 - Applied Research

## PE NUMBER AND TITLE

## 0602601A Combat Vehicle and Automotive Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	35040	34312	37112	33360	31905	33165	34219	35062	Continuing	Continuing
DC05 Armor Exploratory Development	3799	5854	6572	7148	7121	7373	7523	7696	Continuing	Continuing
DC83 TRACTOR CARD	1986	0	0	0	0	0	0	0	0	1986
DC84 TRACTOR TREAD	0	0	2007	2010	2006	2002	1997	1996	Continuing	Continuing
AH39 Voice Instructional Device	0	2056	0	0	0	0	0	0	0	2056
AH77 Advanced Automotive Technology	9804	10318	12440	8445	8402	8843	9407	9707	Continuing	Continuing
AH82 Non-Ozone Depleting Substance Technology	5189	3025	2426	1354	0	0	0	0	0	11994
AH91 Tank & Automotive Technology	14262	13059	13667	14403	14376	14947	15292	15663	Continuing	Continuing

**Mission Description and Budget Item Justification:** This Program Element (PE) advances the state of technologies leading to development of advanced ground combat and tactical vehicles and components that improve the Army's ability to project force and fight, survive against, and defeat future battlefield threats. Increased emphasis is placed on technologies needed for fielded ground vehicles and advanced future ground vehicle systems leading to more mobile, affordable, digitized, lightweight, versatile and highly survivable ground combat systems essential for the post Cold War era. New technology is integrated into innovative vehicle concepts aimed at achieving more deployable advanced armored vehicles that reflect the Army's need to lighten the force while retaining the ability to survive in diverse, worldwide, flexible battlefield environments. These technologies will provide an intra-vehicular digitization compatibility with horizontal battlefield communication requirements. This PE provides critical new technologies to improve vehicle survivability against advanced anti-armor weapons. This PE evaluates non-ozone depleting fire suppressant alternatives to Halon 1301 for armored combat vehicles. This PE funds the National Automotive Center (NAC), which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that are directly focused on benefiting military ground vehicle systems. Two other NAC managed initiatives, Voice Instructional Device and Focus Hope, are also funded in this PE. In addition, the NAC also manages the TARDEC Small Business Innovation Research (SBIR) budget, executes selected SBIR projects and has a Budget Activity 1 component, the National Automotive Center (NAC), funded in PE 0601104A. The NAC has also been nominated as an Army early participant in the Dual Use Applications Program (DUAP). Work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Ground and Sea Vehicle Defense Technology Area Plan (DTAP). The PE is managed by U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI. This program adheres to Tri-Service Reliance Agreements on advanced

Exhibit R-2 (PE 0602601A)

Page 1 of 16 Pages

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE <b>0602601A Combat Vehicle and Automotive Technology</b>	
<p>materials, fuels and lubricants, and ground vehicles with oversight and coordination provided by the Joint Directors of Laboratories. There is no unnecessary duplication of effort within the Army or DoD. Furthermore, the project is coordinated with the Marine Corps office within the Naval Surface Warfare Center and ground vehicle developers within the Departments of Energy, Commerce and Transportation, and the Defense Advanced Research Projects Agency (DARPA). Projects in this PE include non-system specific development efforts directed toward specific military needs, and therefore are appropriate to Budget Activity 2.</p>		

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UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602601A Combat Vehicle and Automotive Technology								DC05	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DC05 Armor Exploratory Development		3799	5854	6572	7148	7121	7373	7523	7696	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project lays the technical foundation to solve critical armor deficiencies and improve the survivability of ground combat vehicles against increasingly lethal anti-armor weapons and mines. Supporting the ultimate objective of lighter, more deployable, more survivable vehicles, the emphasis is on armor technologies that will be compatible with armors suitable for upgrade of current and emerging combat systems (e.g., Abrams, Bradley, Crusader), and light weight structural technologies for advanced combat systems. The project also develops low-burden solutions to the protection of tactical vehicles in war and operations other than war focusing on applique armor for small arms and land mine protection. This project develops on armor technologies to complement innovative non-armor survivability techniques such as those described in project AH91 in this PE. Within the broader field of armor development, this project focuses technology on problems unique to ground combat systems: protection of combat and tactical vehicles against such threats as kinetic energy projectiles, explosively formed penetrators, chemical energy warheads, and blast and fragments from land mines. This project draws upon products from Army programs (e.g., PE 0602618A (Ballistic Technology) projects AH80 and AH81) as well as innovative armors from industry, facilitating the transfer of armor products from those programs to Army systems applications. In addition to development of specific armor concepts, the project includes supporting work in armor materials, bringing together the collective expertise of the Department of Defense, the Department of Energy, and industrial and academic sources. Supporting work also includes development and refinement of armor performance models to assess armor configurations against different threats with sufficiently high fidelity. Other government agencies include: Jet Propulsion Lab, Pasadena, CA; National Institute of Standards and Technology (NIST), Gaithersburg, MD.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3799 - Demonstrated passive and energetic roof armor technologies which can defeat overhead threats.</li> <li>- Enhanced medium vehicle upgrade armors to defeat medium caliber cannon.</li> <li>- Verified smart armor penetrator/defeat mechanism interaction as predicted by hydrocode, and continued development of enhanced armor penetration codes to be used for armor component virtual prototyping, leading to reduction of armor development and production costs.</li> <li>- Developed second generation protection kit for ballistic and mine protection of medium tactical trucks.</li> </ul> <p>Total 3799</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 980 - Demonstrate second generation protection technology for ballistic and mine protection of medium trucks.</li> <li>• 2498 - Demonstrate advanced energetic armor technology in armor configurations for medium combat vehicles.</li> <li>• 1600 - Demonstrate advanced armor configurations compatible with signature management techniques for combat vehicles.</li> <li>• 150 - Develop analytical methods for design of ceramic armors with maximum energy dissipation for defeat of kinetic energy (KE) threats.</li> </ul>											

Project DC05

Page 3 of 16 Pages

Exhibit R-2 (PE 0602601A)

145

Item 10

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602601A Combat Vehicle and Automotive Technology	DC05	
<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>500 - Develop and validate armor penetration mechanics model enhanced to include effects of energetic armors.</li> <li>126 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 5854</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2230 - Demonstrate hybrid reactive armor for light weight future combat vehicle systems.</li> <li>- Develop advanced tandem defeat mechanism for the large tandem anti-tank guided missile (ATGM) threats to close combat vehicles.</li> <li>- Demonstrate advanced overhead protection technologies integrating threat defeat with combat vehicle requirements for vision systems and vehicle hatches.</li> <li>1950 - Develop medium caliber kinetic energy (KE) defeat system and structures for protection of tanks and infantry fighting vehicles (IFVs).</li> <li>- Demonstrate improved smart armor KE threat defeat sensor to support technology selection for future combat systems.</li> <li>- Develop and validate analytical methods for design of ceramic armors with maximum energy dissipation for defeat of KE threats.</li> <li>2392 - Validate armor penetration mechanics model augmented to include energetic armor effects to shorten design cycle and reduce test costs.</li> <li>- Initiate component demonstrations on a tactical wheeled vehicle to include advanced mine and rocket propelled grenade (RPG) protection.</li> </ul> <p>Total 6572</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1950 - Develop lightweight alternative non-energetic reactive armor materials for future passive armors in medium and heavy vehicles.</li> <li>- Demonstrate combat vehicle armors incorporating the advanced tandem ATGM defeat mechanism.</li> <li>- Develop novel hypervelocity penetrator defeat mechanism to support future combat systems.</li> <li>2098 - Develop low back pressure air intake/exhaust grille system with medium caliber protection to improve protection of fielded and developmental combat systems.</li> <li>- Validate analytical methods for design of ceramic armor design through use of analytical design models.</li> <li>- Demonstrate 25% reduction in typical test cost for armor design through use of analytical design models.</li> <li>3100 - Develop integrated smart armor sensor package for KE threat defeat and demonstrate frontal armor system with 35% weight savings over baseline system.</li> <li>- Complete and test survivability appliques for tactical vehicles.</li> </ul> <p>Total 7148</p>			

Project DC05

Page 4 of 16 Pages

Exhibit R-2 (PE 0602601A)

146

Item 10

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE			DC05
<b>2 - Applied Research</b>	<b>0602601A Combat Vehicle and Automotive Technology</b>			
<b>B. Project Change Summary</b>				
FY 1997 President's Budget		FY 1996	FY 1997	FY 1998
Appropriated Value		3882	6314	6280
Adjustments to Appropriated Value		3799	5854	
FY 1998 Pres Bud Request		3799	5854	6572
				7148

Project DC05

Page 5 of 16 Pages

Exhibit R-2 (PE 0602601A)

147

Item 10

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
2 - Applied Research		0602601A Combat Vehicle and Automotive Technology								AH39																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
AH39	Voice Instructional Device	0	2056	0	0	0	0	0	0	0	2056																				
<p><b>A. Mission Description and Justification:</b> This project was established for a NAC management effort in response to Congressional direction and funding only for the design, development and testing of a Voice Instructional Device (VID) for use with fuel tankers, the Palletized Loading System and M1022A1 Dolly Wheeled Hydraulic System. The VID provides audible instructions to its operator, providing voice instructions for diagnostics and maintenance.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2006 - Initiate a NAC effort, through a collaborative technology contract, for the design, development and test of Voice Instructional Device.</li> <li>50 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 2056</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td></td> <td>2056</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>2056</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997 - Funding provided by Congress (+2056) for design, development and testing of a Voice Instructional Device.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value		2056			FY 1998 Pres Bud Request	0	2056	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value		2056																													
FY 1998 Pres Bud Request	0	2056	0	0																											

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

## BUDGET ACTIVITY

## 2 - Applied Research

## PE NUMBER AND TITLE

0602601A Combat Vehicle and Automotive

## Technology

## PROJECT

AH77

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH77 Advanced Automotive Technology	9804	10318	12440	8445	8402	8843	9407	9707	Continuing	Continuing

**A. Mission Description and Justification:** This project funds the National Automotive Center (NAC), which leverages commercial industry's large investment in automotive technology research and development and initiates shared technology programs that are focused on benefiting military ground vehicle systems. The NAC, located at the Tank-Automotive and Armaments Command (TACOM), is part of the Tank-Automotive Research, Development and Engineering Center (TARDEC). The NAC serves as the catalyst linking industry, academia and government agencies for the development and exchange of automotive technologies. The NAC executes collaborative research and development (R&D) contracts, cooperative agreements, and other initiatives to leverage commercial industry's investment in well-defined, high return-on-investment areas tied to key Army science and technology objectives for advanced land combat. The NAC focuses collaborative R&D contracts on key military automotive technology thrust areas to include: mobility, electronics, propulsion, logistics, safety and environmental protection with the goal of (a) improving the performance and endurance of ground vehicle fleets, and (b) reducing ground vehicle design, manufacturing, production, and operating and support costs. Two-way industry/government technology transfer is pursued under Cooperative Research and Development Agreements (CRADAs). The activities of the NAC are supported by other government agencies via a linkage created under Memoranda of Agreement, and oversight is provided by a Senior Advisory Board which includes representation from program executive offices for tactical and combat vehicles, the User, the Army staff, the U.S. Marine Corps and OSD. These linkages permit the NAC to consolidate the collective expertise of federal government departments such as Energy, Transportation and Commerce and other DoD agencies. The NAC performs basic research in PE 0601104A, project BH73 (NAC) in addition to two efforts also funded in this PE, VID (see AH39) and Focus Hope (see AH91). The NAC also manages the TARDEC Small Business Innovation Research (SBIR) budget, and executes selected SBIR projects. Major contractors include: Environmental Institute of Michigan, Ann Arbor, MI; Science Applications International Corporation, Warren, MI; Radian Inc., Alexandria, VA; Michigan Technological University, Houghton, MI; Picotronics, Ann Arbor, MI; University of Michigan, Ann Arbor, MI; VSE, Alexandria, VA; Oakland University, Rochester, MI; TASC, Reading, MA; Ford, Dearborn, MI; Chrysler, Auburn Heights, MI; General Motors, Warren, MI (Cooperative Agreement); Optimetrics, Ann Arbor, MI; Wayne State University, Detroit, MI; Pinnacle Research, Los Gatos, CA; Southwest Research, San Antonio, TX; Westinghouse Electric, Pittsburgh, PA; Allied Signal, Stratford, CT; Failure Analysis, Redmond, WA; University of Detroit-Mercy, Detroit, MI; Barnes & Reinicke, Troy, MI; ICRC Energy, LaLa, KA; University of Alaska, Fairbanks, AK; Cummins, Columbus, ID; VSE Corp., Alexandria, VA; University of Texas, Austin, TX; General Dynamics Land Systems, Sterling Heights, MI; Pentastar, Huntsville, AL; Baum, Romstedt Technology Research Corp. (BRTRC Inc.), Fairfax, VA.

## FY 1996 Accomplishments:

- 5000 - Awarded 13 new collaborative automotive technology contracts that focused on key commercial technology initiatives in electronics, safety, propulsion, environment, mobility, and logistics. Technology areas include corrosion protection, electromechanical suspensions, driver's automation aids, thermal imaging diagnostics for automotive components, and waste heat recovery/reutilization.
- Completed collision warning system (CWS) demonstration which adapted a commercial automotive collision detection system to military vehicles to reduce convoy accidents and save soldier lives.

Project AH77

Page 7 of 16 Pages

Exhibit R-2 (PE 0602601A)

149

Item 10

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

2 - Applied Research

PE NUMBER AND TITLE

0602601A Combat Vehicle and Automotive  
Technology

PROJECT

AH77

## FY 1996 Accomplishments: (continued)

- Initiated a program to study and improve (reduced weight, increased efficiency, and reduced emissions) the HMMWV 6.2/6.5 liter engine by exploiting commercial Silicon Carbide Whisker Metal Matrix Composites to produce stronger engine parts of improved design.
- Initiated a cooperative agreement to advance state of the art technology in high output diesel engine technology.
- Performed a study to define requirements for a joint military/commercial technology demonstration program using advanced commercial technologies modified to conform to Army needs.
- 4804
  - Initiated a cooperative agreement for advancing the state of the art of four stroke direct injection (4SDI) diesel engine technology with Ford, General Motors, and Chrysler, directed toward improvement of military, as well as commercial, propulsion systems.
  - Initiated "Smart Truck" technology integration program that adapts commercial digital multiplexed databus technology on tactical wheeled vehicles to demonstrate rapid electronic commercial intelligent subsystem integration and interactive vehicle diagnostic capability.
  - Initiated a modeling/simulation effort to support evaluation and integration of technologies, including 4SDI diesel engine and smart truck.
  - Integrated key technologies from collaborative R&D contracts into existing and new military demonstration programs. Key technologies include advanced traction control, hybrid batteries, and ultracapacitors.

Total 9804

## FY 1997 Planned Program:

- 5831
  - Evaluate on-going collaborative R&D contracts (from FY 1996) to award additional funding increments for high return-on-investment technologies.
  - Award competitive collaborative R&D contracts or cooperative agreements, as appropriate, to acquire innovative and advanced commercial automotive technologies in the key military technology thrust areas of electronics, propulsion, safety, environment, mobility and logistics.
  - Continue Smart Truck technology integration demonstration program that adapts commercial digital multiplexed databus technology into tactical wheeled vehicles to include intelligent subsystems, such as global positioning system (GPS), navigation aids, collision warning devices, and communication links.
- 4260
  - Continue the cooperative agreement for advancing the state-of-the-art for four-stroke direct injection (4SDI) diesel with specific focus on high-temperature materials, exhaust after-treatments and low-heat rejection designs directed toward improvement of military propulsion systems.
  - Initiate a medium weight class combat vehicle chassis testbed program to evaluate advanced commercial hybrid electric drive components in cooperation with DARPA.
  - Continue the program to improve (reduce weight, increase efficiency and reduce emissions) the HMMWV diesel engine for enhanced military performance and continued commercial demand by exploiting NAC-funded commercial Silicon Carbide Whisker implantation to produce stronger and more efficient engine parts.
  - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- 227

Total 10318

Project AH77

Page 8 of 16 Pages

Exhibit R-2 (PE 0602601A)

150

Item 10

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602601A Combat Vehicle and Automotive

Technology

PROJECT

AH77

## FY 1998 Planned Program:

- 6150 - Continue evaluation of FY97 collaborative contracts for additional funding increments for high return investment technologies.
- Award collaborative R&D contracts or cooperative agreements, as appropriate, to acquire innovative and advanced commercial automotive related technologies in key military areas of electronics, propulsion, safety, environment, mobility and logistics.
- Continue advancing the state-of-the-art for 4SDI diesel with special emphasis on the light truck, generator sets and hybrid vehicles.
- 5740 - Continue hybrid electric drive commercial application.
- Initiate and coordinate development of an advanced automotive based product development software framework.
- Continue Smart Truck program technology demonstration of commercial automotive data/communication links to all weight classes of tactical wheeled vehicles.
- 550 - Demonstrate capabilities of Head Up displays for dual need applications.

Total

12440

## FY 1999 Planned Program:

- 5190 - Continue evaluation of FY97 and FY98 collaborative contracts or cooperative agreements, as appropriate, for additional funding increments for high return investment technologies.
- Award collaborative R&D contracts or cooperative agreements, as appropriate, to acquire innovative and advanced commercial automotive related technologies in key military areas of electronics, propulsion, safety, environment, mobility and logistics.
- Continue automotive-based product development software framework.
- Continue the Smart Truck program technology enhancements demonstration.
- 3255 - Advance the state-of-the-art of 4SDI diesel engines.
- Continue to expand collaborative effort to increase diesel engine efficiency/performance.
- Expand hybrid electric drive commercial/military application.
- Research and demonstrate advanced vision sensors and displays.

Total

8445

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

Change Summary Explanation: Funding: FY 1996 - Funds reprogrammed to higher priority requirements (-2000); Congressional reductions and rescissions (-281).

FY 1996	FY 1997	FY 1998	FY 1999
12085	11131	12830	14480
12424	10318		
-2620			
9804	10318	12440	8445

Project AH77

Page 9 of 16 Pages

Exhibit R-2 (PE 0602601A)

151

Item 10

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602601A Combat Vehicle and Automotive Technology								AH77	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH82	Non-Ozone Depleting Substance Technology	5189	3025	2426	1354	0	0	0	0	0	11994
<p><b>A. Mission Description and Justification:</b> This project demonstrates environmentally and toxicologically acceptable replacements for Halon 1301 in fire suppression systems in crew occupied compartments of ground combat vehicles. Due to the ozone depleting potential of Halon 1301, the Clean Air Act of 1990 and DoD Directive 6050.9 require that alternate extinguishing agents be identified to maintain current crew and vehicle survivability and supportability. Testing will be performed to meet Tier 1-3 Army Surgeon General and Environmental Protection Agency requirements. Funds in this project identify and evaluate non-ozone depleting substances for application to military vehicles. Investments to date have been successful in identifying two agents suitable for ground vehicle engine compartments. Work continues to find a suitable agent for crew compartments. Alternative agents are purchased from DuPont Inc., Deepwater, NJ and Great Lakes Chemical, Lafayette, IN.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>5189 - Completed performance testing of two initial agents, FM-200 (Heptafluoropropane) and FE-13 (Trifluoromethane), in existing hardware.</li> <li>- Reviewed tier 1 (short term single exposure) acute toxicity results and initiated tier 2 (longer term (14-90 Day) multiple exposure) subchronic toxicity testing.</li> <li>- Conducted performance and toxicology review to downselect agent for vehicle testing.</li> <li>- Selected three alternative agents to enter into testing, pending unsatisfactory review of initial agents.</li> </ul>											
Total		5189									
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2201 - Conduct performance testing on alternative agents.</li> <li>400 - Complete tier 2 (longer term (14-90 Day) multiple exposure) subchronic toxicity studies of alternative agents.</li> <li>350 - Initiate tier 3 (long term (1 year) multiple exposure) chronic toxicity studies, as required, based on tier 2 results.</li> <li>74 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>											
Total		3025									
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1906 - Continue performance testing on alternate agents.</li> <li>300 - Continue tier 3 (long term; up to three years, multiple exposure) chronic toxicology studies.</li> </ul>											

Project AH77

Page 10 of 16 Pages

Exhibit R-2 (PE 0602601A)

152

Item 10

UNCLASSIFIED



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE				AH82
<b>2 - Applied Research</b>	<b>0602601A Combat Vehicle and Automotive Technology</b>				
<b>FY 1998 Planned Program: (continued)</b>					
• 100 - Develop system design guidelines for alternate agents.					
• 120 - As a result of preliminary tier 2 studies, conduct toxicology studies of break-down products in alternate agents.					
Total					
2426					
<b>FY 1999 Planned Program:</b>					
• 900 - Complete performance testing on alternate agents.					
• 100 - Complete system design guidelines.					
• 304 - Complete long-term toxicology studies.					
• 50 - Complete breakdown product studies.					
Total					
1354					
<b>B. Project Change Summary</b>					
FY 1997 President's Budget		FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value		5323	3262	2420	1342
Adjustments to Appropriated Value		5189	3025		
FY 1998 Pres Bud Request		0			
		5189	3025	2426	1354

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602601A Combat Vehicle and Automotive Technology								AH82	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH91	Tank & Automotive Technology	14262	13059	13667	14403	14376	14947	15292	15663	Continuing	Continuing

**A. Mission Description and Justification:** This project provides innovative vehicle concepts and component technologies leading to product improvements to fielded equipment and to the development of advanced systems that will enable the Army to maintain superiority to fight and survive against diverse threats. Conceptual designs, virtual prototyping, and performance analyses and battlefield wargaming of ground vehicle systems identify promising emerging technologies in support of Training and Doctrine Command (TRADOC) Integrated Concept Teams and quantify benefits, burdens and trade-offs related to ground vehicle applications. The project includes eight areas: (1) vehicle concepts and technology integration; (2) mobility; (3) integrated survivability; (4) vehicle electronics (VETRONICS) and digitization; (5) advanced vehicle structures; (6) simulation/analysis (7) military fuels and lubricants; and (8) water purification technology. Technology initiatives are being pursued to address advanced mobility, survivability and lethality requirements of lighter, digitized, more deployable vehicles. Activities are closely coordinated through the Army Training and Doctrine Command's Mounted and Dismounted Battlespace Battle Labs; Program Executive Office for Ground Combat and Support Systems; and the Army Research Laboratory (ARL)/ TACOM Advanced Armored Vehicle Technology focus program. This increases opportunities for transition of ARL corporate research into ground vehicles. Tank and automotive virtual prototyping provides seamless sharing of databases/engineering models, allowing more rapid and efficient integration, assessment and transfer of DoD and commercial vehicle technologies. Vehicle electronics will be based on adapting commercial electronic standards and architectures for combat vehicle battlefield unique requirements through the VETRONICS open system architecture (VOSA) to leverage commercial investments and facilitate upgrades to maintain pace with this rapidly evolving technology area. The survivability technologies, which include non-armor approaches such as signature reduction, countermeasures, and damage reduction, complement, but do not duplicate, work performed under the armor exploratory development project (DC05) in this PE. Executes a NAC initiative with Focus Hope to investigate advance materials manufacturing processes development to modify/retrofit diesel engine components for application to ground combat vehicles. Other government agencies include: Defense Advanced Research Projects Agency, Arlington, VA; Oakridge National Laboratory, Oakridge, TN; Red River Army Depot, Texas, TX. Major contractors include: Cadillac Gage Textron, New Orleans LA; Soucy International, Drummondville, Quebec; Pentastar Huntsville, AL; Michigan Technological University, Houghton MI; United Defense Limited Partnership, San Jose, CA; University of Texas, Arlington TX; Oakland University, Rochester Hills, MI; Gonzales Engineering, Troy, MI; McDonnell Douglas, St. Louis, MO; University of Dayton Research Center, Dayton, OH; Monterey Technologies Inc., Monterey, CA; DCS Corp, Alexandria, VA.; Texas Instruments, Dallas, TX; Southwest Research Institute, San Antonio, TX; Separation Systems Inc., San Diego, CA.

**FY 1996 Accomplishments:**

- 5674 - Developed advanced tank, scout, and other combat vehicle concepts, via the virtual prototyping process, solid modeling and battlefield effectiveness analysis, performed a technology assessment, and assessed the battlefield impact and affordability of the projected systems and individual technologies.
- Completed initial design of baseline virtual prototyping architecture kernel to facilitate the transfer of design and performance information/data between distributed DoD and industry research and development groups.

Project AH82

Page 12 of 16 Pages

Exhibit R-2 (PE 0602601A)

154

Item 10

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b> February 1997
<b>BUDGET ACTIVITY</b>	<b>PE NUMBER AND TITLE</b>	<b>PROJECT</b>
<b>2 - Applied Research</b>	<b>0602601A Combat Vehicle and Automotive Technology</b>	<b>AH91</b>

  

**FY 1996 Accomplishments: (continued)**

- 5283 - Demonstrated advanced hybrid electric drive systems in tracked and wheeled vehicles in coordination with DARPA to determine the mission expansion capability of military vehicles with hybrid electric drives. Developed advanced enabling electric drive technologies in the areas of power electronics, storage devices and motors/generators to meet future vehicle needs.
- Developed band track for light vehicle class combat vehicle testbed to increase mobility and stealth; developed electric active suspension concepts to increase mobility and move toward all-electric vehicle. Developed semiactive suspension on 25-ton vehicle.
- Evaluated high temperature diesel head materials, thermal barrier coatings for pistons and high temperature synthetic lubricants.
- Completed transmission evaluations on candidate environmentally-compliant tactical engine oils and developed performance requirements for new 0W-30 arctic grade and transitioned to DLA; completed chromatographic analytical procedure evaluations for predicting fuel quality and initiated correlation programs.
- Investigated emerging technologies such as aerogels, mosaic processes, laminated cellulose triacetate and interfacial polymerization of secondary amines. Interfacial polymerization showed the most potential for reverse osmosis membranes with chlorine resistance.
- 3305 - Completed preliminary characterization of non-linear optical protection materials and initiated development of novel fiber optic periscope design to enhance the dynamic range of combat vehicle vision device laser protection.
- Designed and tested improved ballistic grill system on a combat vehicle system; obtained initial validation of TARDEC visual signature virtual prototyping model; developed concepts for integrated signature armor.
- Optimize VETRONICS architecture baseline for scout class vehicle.

Total 14262

**FY 1997 Planned Program:**

- 3379 - Perform advanced vehicle concept studies through virtual prototyping, solid modeling and battlefield effectiveness analysis to implement planning for and support of the TRADOC Integrated Concept Teams (ICTs).
- Complete detailed design of baseline virtual prototyping architecture which will demonstrate system/component level configuration management to enable distributed/concurrent ground vehicle technology development; demonstrate remote access of DoD virtual prototype models at selected locations; implement Janus model at TARDEC to perform operational effectiveness analysis.
- 4248 - Develop and test band track components for increased road wheel unit loading; develop noncausal active suspension algorithms using preview sensor data; demonstrate electric suspension in the laboratory.
- Conduct NATO Reference Mobility Model analysis of Future Scout Cavalry System mobility requirements as stated in the Operational Requirements Document.

Project AH91

Page 13 of 16 Pages

Exhibit R-2 (PE 0602601A)

155

Item 10

UNCLASSIFIED

**UNCLASSIFIED**

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b> <b>February 1997</b>
<b>BUDGET ACTIVITY</b> <b>2 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602601A Combat Vehicle and Automotive Technology</b>	<b>PROJECT</b> <b>AH91</b>

  

<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Complete contracted study to define technology for heavy combat vehicle diesel engine and methods for propulsion system volume reduction.</li> <li>- Complete correlation program of chromatographic analytical procedure(s) for predicting fuel performance properties from compositional measurements; develop software package for data integration and transition chromatographic analytical procedure(s) and model to Petroleum Quality Analysis System. Complete literature/market survey on energy enhancement technologies for ground fuel applications; complete laboratory characterization of experimental additives and blending ingredients.</li> <li>- Optimize operating property requirements of selected water purification technologies and conduct bench scale analysis of leading candidates which will meet or exceed the performance of reverse osmosis membranes.</li> <li>- Initiate development of retrofitable wide angle optical viewing system design which can incorporate agile laser protection.</li> <li>- Complete advanced survivability evaluation using optimization tools for the assessment of reduced signature for a scout class vehicle. Complete fabrication of integrated low observable (LO) and ballistic skirts. Complete design and fabrication of integrated LO and ballistic laser warning receiver concept.</li> <li>- Develop architecture models for ground vehicle domain.</li> <li>- Initiate an effort to investigate advance materials manufacturing processes development to modify/retrofit diesel engine components for application to ground combat vehicles, through the NAC via a collaborative automotive technology contract with Focus Hope.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <table border="0"> <tr> <td style="text-align: right;">3877</td> <td></td> </tr> <tr> <td style="text-align: right;">1500</td> <td></td> </tr> <tr> <td style="text-align: right;">55</td> <td></td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right;">13059</td> </tr> </table>	3877		1500		55		Total	13059	<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>- Based on the parametric analysis, develop computer generated vehicle concepts and complete preliminary concept assessments.</li> <li>- Support TRADOC ICTs with advanced concepts and analysis.</li> <li>- Perform concept level subsystem integration studies and tradeoff analysis for key FCS technologies.</li> <li>- Initiate an evaluation and refinement of the virtual prototyping architecture, verifying and validating the ability to reduce development time, cost and testing requirements when used in place of traditional development methods.</li> <li>- Develop band track/components (drive and tensioner systems) for scout vehicle applications in the 22 ton weight class. Develop semiactive suspension for a scout class vehicle to increase cross country speed, improve ride and sensor platform stability. Design and fabricate high power density single cylinder engine based upon study results.</li> <li>- Complete demonstration of an innovative water purification technology to improve flow rate, shelf life, increased temperature and pH range and chlorine tolerance.</li> </ul> <table border="0"> <tr> <td style="text-align: right;">4692</td> <td></td> </tr> <tr> <td style="text-align: right;">4725</td> <td></td> </tr> </table>	4692		4725	
3877													
1500													
55													
Total	13059												
4692													
4725													

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602601A Combat Vehicle and Automotive

Technology

PROJECT

AH91

## FY 1998 Planned Program: (continued)

- - Develop silicon carbide switches for ground vehicle electric drive application in conjunction with U.S. Navy. Demonstrate and evaluate combat vehicle applications of Power Electronics Building Blocks Metal Oxide Semiconductor controlled thyristors previously developed by the Navy and Air Force.
- 3250 - Define optimum survivability suite for scout class vehicle.
- - Continue development of agile laser protected wide angle vision system.
- - Demonstrate and validate ground vehicle reusable crew station simulation architecture.
- - Test integrated signature ballistic air intake grille system and integrated LO and ballistic skirts.
- - Complete the NAC managed Focus Hope advance material manufacturing processes development and demonstrate production of diesel engine components for Army ground vehicles.

Total 13667

## FY 1999 Planned Program:

- 5245 - Perform concept level engineering and operational effectiveness analysis on future combat system concepts in support of Armor/Infantry Centers.
- - Provide technology tradeoff analysis based on future combat systems requirements.
- - Complete evaluation and refinement of the virtual prototyping architecture, verifying and validating the ability to reduce development time, cost and testing requirements when used in place of traditional development methods.
- 5633 - Test nitrile rubber track for durability. Develop track tensioning system for heavy vehicle applications. Develop a lightweight aluminum metal matrix track for heavy combat vehicle applications.
- - Develop semiactive suspension for improved cross-country performance of heavy combat vehicle class; develop electric actuators for active suspension units for both light and heavy all-electric combat vehicles.
- - Integrate compact silicon carbide power electronics into ground vehicle electric drive demonstrator; develop single cylinder high power density diesel engine for performance and durability.
- - Evaluation of candidate fuel energy enhancement materials at two locations using fleets encompassing cross section of Army combat and tactical vehicles and equipment; develop user guidance for materials and transition to DLA.
- 3525 - Demonstrate retrofittable wide angle optical viewing system design which can incorporate laser limiting materials.
- - Demonstrate integrated signature-ballistic side armor system for light and medium weight future vehicle systems.
- - Define ground vehicle reusable software application program interface (API) baseline.

Total 14403

Project AH91

Page 15 of 16 Pages

Exhibit R-2 (PE 0602601A)

157

Item 10

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE				
2 - Applied Research	0602601A Combat Vehicle and Automotive Technology		AH91		
<b>B. Project Change Summary</b>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	
FY 1997 President's Budget	14802	14127	15160	15924	
Appropriated Value	14262	13340			
Adjustments to Appropriated Value	0	-281			
FY 1998 Pres Bud Request	14262	13059	13667	14403	

Project AH91

Page 16 of 16 Pages

Exhibit R-2 (PE 0602601A)

158

Item 10

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602618A Ballistics Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	34647	39913	33317	37598	34612	37878	38709	40366	Continuing	Continuing
AH37 Liquid Propellant Technology	0	7343	0	0	0	0	0	0	0	7343
AH75 Electric Gun Technology	7585	7839	8032	10159	6865	7215	7181	7239	Continuing	Continuing
AH80 Ballistics Technology	20433	20328	20998	22642	23069	25409	26168	27643	Continuing	Continuing
AH81 Armor/Anti-Armor Technology	6629	4403	4287	4797	4678	5254	5360	5484	Continuing	Continuing

**Mission Description and Budget Item Justification:** This program element (PE) provides ballistic technologies required for armaments and armor to allow U.S. dominance in future conflicts across a full spectrum of threats in a global context. Project AH37 is directed toward solving the remaining technology challenges identified under previous attempts to weaponize liquid propellant (LP) technology. It capitalizes on the large Army investment in LP technology. Project AH75 focuses on pulsed power technologies for electric armaments which offer the potential to field leap-ahead capability in providing hypervelocity and hyperenergy launch well above the ability of the conventional cannon. It also includes work in hypervelocity penetrator effectiveness and electrothermal chemical (ETC) technology that will greatly increase anti-armor capabilities. Project AH80 is focused on applied research in ballistics technologies including warhead mechanics, penetrator mechanics, munition-target interactions, terminal effects, propulsion dynamics, launch and flight dynamics, remote sensing and computational physics. Corresponding emphasis is placed on advanced armor technology and vulnerability analysis technologies to optimize effectiveness and survivability of armored combat vehicles. Project AH81 taps the innovation of industry and pursues the most promising and affordable approaches to developing armor/anti-armor technologies. Work in this program element has been coordinated with the other military services through the Weapons Technology Area Plan to prevent duplication of effort and to maximize the return on investment. One result of this process is the Army's leveraging of Navy and Defense Special Weapons Agency investments for ETC technology demonstrations. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Page 1 of 9 Pages

Exhibit R-2 (PE 0602618A)

159

Item 11

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602618A Ballistics Technology								AH37	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH37	Liquid Propellant Technology	0	7343	0	0	0	0	0	0	0	7343
<p><b>A. Mission Description and Justification:</b> This project will focus on maturation of liquid propellant (LP) technology with the intent to evaluate LP as a means of achieving increased lethality and/or survivability for future weapon systems applications. Technology challenges including pressure oscillations, material compatibility, and reliability/durability of the propellant in a battlefield environment will be addressed and advantages of an LP weapon will be explored.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>7164 -Identify improved hydroxyl ammonium nitrate (HAN)-based propellant(s) with potential for increasing muzzle energy of an LP gun over conventional powder gun.</li> <li>-Conduct studies and tests to show improved performance of LP formulations with reduced pressure oscillations.</li> <li>-Acquire thermal stability data on liquid propellants with stabilizing additives.</li> <li>-Develop improved ballistic models for LP ; conduct ballistic tests on improved LP formulations and use data to validate models.</li> <li>-Obtain jet breakup and propellant decomposition data using liquid propellant at low pressure.</li> <li>179 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 7343</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 97.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget</p> <p>Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request</p> <p>Change Summary Explanation: Funding: FY 1997-Project established by Congress to focus efforts on liquid propellant applied research.</p>											

Project AH37

Page 2 of 9 Pages

Exhibit R-2 (PE 0602618A)

160

Item 11

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

## 0602618A Ballistics Technology

AH75

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH75 Electric Gun Technology	7585	7839	8032	10159	6865	7215	7181	7239	Continuing	Continuing

**A. Mission Description and Justification:** This project provides oversight and accountability for the Army electric armaments technology program, which is managed by the Army Research Laboratory (ARL). Future armored combat vehicles will require more lethal, yet compact main armament systems capable of defeating protection levels greatly in excess of currently experienced values. Electric armaments offer the potential to field a leap-ahead capability by providing hypervelocity and/or hyperenergy launch greatly above the ability of the conventional cannon. Electric armaments potentially can be fully integrated with electric propulsion and electromagnetic armor systems to provide the efficient, highly mobile, and deployable armored force required by the nation. This project funds a contractual effort to develop an efficient pulsed power system for electromagnetic (EM) launch. The goal is to demonstrate pulse power technology (rotating machines) with energy density of three Joules per gram (J/g) and to identify a clear potential for growth to ten J/g. In addition, this project supports the development of electrothermal chemical (ETC) technology which is a joint effort with the Defense Special Weapons Agency (DSWA). The goal of the ETC effort is to demonstrate 140mm lethality from a 120mm cannon.

## FY 1996 Accomplishments:

- 2661 - Developed and evaluated three candidate ETC concepts for 120mm.
  - Rebuilt subscale compensator rotor.
  - Tested compensator into a static load.
  - Integrated compensator with 45mm railgun and tested into a dynamic load.
- 4924 - Developed switching and rectifiers for self-excitation.
  - Designed and began fabrication of fully compensated machine.
  - Designed and tested high performance armature/launch packages.

Total

7585

## FY 1997 Planned Program:

- 5647 - Complete subscale rotor and conduct performance tests to validate fabrication and design; demonstrate full machine rotational rate, structural integrity, and energy density of 1.5 J/g.
  - Initiate design of a compensator which will demonstrate energy density of 3 J/g (Exit Criteria Machine - ECM) including required switching and power conditioning electronics.
- 2000 - Conduct experiments to validate performance potential of state-of-the-art switching and power conditioning electronics for the ECM.
- 192 - Conduct reduced scale tests of up to six ETC-ignition and propulsion concepts.
- 7839 - Small business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

7839

Project AH75

Page 3 of 9 Pages

Exhibit R-2 (PE 0602618A)

161

Item 11

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
<b>2 - Applied Research</b>	<b>0602618A Ballistics Technology</b>	<b>February 1997</b>	<b>AH75</b>																									
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6232 - Test subscale rotor to 12,000 rpm and demonstrate full electrical performance through both static and dynamic load representative of an EM launcher.</li> <li>1800 - Conduct critical component tests to validate ECM design and initiate fabrication of compulsator based on validated design.</li> <li>8032 - Conduct tests to demonstrate potential of two ETC-ignition and propulsion systems in 120mm, M256 cannon.</li> </ul> <p><b>Total</b> 8032</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>7959 - Complete fabrication of ECM and demonstrate energy density of 3 J/g through a representative dynamic load.</li> <li>2200 - Provide a clear technology roadmap to achieving energy density of 10 J/g.</li> <li>10159 - Test the single best ETC-ignition concept to demonstrate 140mm performance (17 MJ muzzle energy) in a 120mm XM291 cannon.</li> </ul> <p><b>Total</b> 10159</p> <p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>7781</td> <td>5407</td> <td>6346</td> <td>7427</td> </tr> <tr> <td>Appropriated Value</td> <td>8000</td> <td>7839</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-415</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>7585</td> <td>7839</td> <td>8032</td> <td>10159</td> </tr> </tbody> </table> <p>Change Summary Explanation: FY 1997 Congressional add (+2600) for electric gun development.  FY 1998 funding increased (+1686) to provide critical increased level of effort in EM pulse power development.  FY 1999 funding increased (+2732) to provide critical increased level of effort in EM pulse power development.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	7781	5407	6346	7427	Appropriated Value	8000	7839			Adjustments to Appropriated Value	-415				FY 1998 Pres Bud Request	7585	7839	8032	10159
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	7781	5407	6346	7427																								
Appropriated Value	8000	7839																										
Adjustments to Appropriated Value	-415																											
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Project AH75

Page 4 of 9 Pages

Exhibit R-2 (PE 0602618A)

162

Item 11

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602618A Ballistics Technology								AH80	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH80	Ballistics Technology	20433	20328	20998	22642	23069	25409	26168	27643	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project produces key technologies required for armaments and armor to allow U.S. dominance in future conflicts across a full spectrum of threats in a global context. This project supports ballistic technology advances in vehicle survivability, direct fire armament capabilities, indirect fire support, and weapon effectiveness evaluation in order to be able to design the most effective weapon capabilities and optimally protect against the most dangerous threats. Emphasis will be placed on advancement of simulation and modeling technologies to foster the exploitation of the Army's supercomputer network. The modeling and simulation tools created are used to produce analyses that support the independent evaluation process for acquisition milestone decisions. This project continues to support extensive experimental programs to advance the state-of-the-art in ballistics technologies.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 11314 - Investigated diode laser technology for the direct ignition of solid/liquid propellants and modeled in-bore and free flight projectile stability, surface heating and ablation of hypervelocity projectiles.</li> <li>- Demonstrated an armor capable of defeating projectiles over a wide velocity spectrum.</li> <li>- Integrated ETC tank cartridge (plasma generator, bullets, propellant), and demonstrated improved electrical enhancement factors while maintaining enhanced performance.</li> <li>- For spinning projectiles or submunitions, developed a rotation-compensated warhead concept; for long rod penetrators, demonstrated a micro-rocket motor to reduce drag.</li> <li>• 9119 - Integrated target acquisition, image stabilization and target cueing with the inertial reticle system fire control for secondary armament.</li> <li>- Implemented ballistic shock and secondary spall algorithms in the stochastic vulnerability/lethality analysis code in support of live-fire test and evaluation of U.S. Army systems.</li> <li>- Simulated the resin transfer molding processes used by United Defense for manufacturing Composite Armored Vehicle components. Improved distributed interactive simulation (DIS) compliant smoke/obscurants models for insertion into synthetic environments.</li> </ul>											
Total		20433									
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 15558 - Develop enabling technologies for lightweight weapons and focused warhead effects for the light and special operations forces, which improve their effectiveness in remote locations and in operations other than war.</li> <li>- Test artillery projectile technologies which provide gliding flight and enhanced accuracy for extended range.</li> <li>- Provide technology to enhance weapon lethality for applications such as long standoff, counter active protection and missile applications.</li> </ul>											

Project AH80

Page 5 of 9 Pages

Exhibit R-2 (PE 0602618A)

163

Item 11

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602618A Ballistics Technology	AH80	
FY 1997 Planned Program: (continued)			
		<ul style="list-style-type: none"><li>- Demonstrate technologies to allow lightweight protection of armored systems to advanced threats such as kinetic energy weapons and top attack weapons.</li><li>- Develop unique armor and armaments technologies which will provide synergy with battlefield digitization to enhance both lethality and survivability.</li><li>- Conduct theoretical and experimental studies of novel gun propulsion concepts for laboratory and weapon system applications to provide the energy required to defeat evolving threats.</li><li>- Develop thick composite technology using resin transfer molding process.</li><li>- Develop engineering-based methods to compute ballistic damage response and performance of combat system components, including main rotor blades, drive trains, and electro-optics.</li><li>- Demonstrate integration of the multi-user prototype synthetic environment with computer generated individual combatants. Develop mission planning and rehearsal tools simulating the battlefield to quickly adjust mission plans to changing battlefield situations.</li></ul>	
•	3821		
•	949		
Total	20328		
FY 1998 Planned Program:			
		<ul style="list-style-type: none"><li>-Advance technologies such as recoil mitigation and advanced warheads which will provide enhanced capabilities for light forces in operations across the threat spectrum. Develop weaponry which addresses the needs of soldiers in operations other than war.</li><li>-Apply advanced sensing and guidance technology to artillery projectiles, missiles and fire control concepts to provide improved weapon accuracy and associated relief from logistic burden.</li><li>-Enhance direct fire lethality by introducing novel propulsion concepts and advanced warhead designs including multi-stage shaped charge and kinetic energy precursor technology.</li><li>-Investigate advanced basal and appliqué armor technology which, combined with lightweight structures, will provide new approaches to armoring vehicles.</li><li>-Implement blast damage algorithm for component damage from small warheads to optimize lethality/survivability of smart indirect-fire munitions /ground systems.</li><li>-Implement physical models of vulnerability and weapons effects in real time for interactive simulations.</li></ul>	
•	4273		
•	2092		
Total	20998		

Project AH80

Page 6 of 9 Pages

Exhibit R-2 (PE 0602618A)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
<b>2 - Applied Research</b>	<b>0602618A Ballistics Technology</b>	<b>February 1997</b>	<b>AH80</b>																									
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 14143 -Determine the effects of advanced propellant technology on gun tube erosion and gun accuracy; investigate advances in direct fire lethal mechanisms.</li> <li>• 6527 -Optimize guidance and flight technologies to extend range and improve accuracy of indirect fire weaponry.</li> <li>• 1972 -Develop technology which will provide new operational capabilities to soldiers in low intensity conflicts and operations other than war.</li> <li>• -Enhance the armor technology base to address the lethality of advanced threats.</li> <li>• -Implement vulnerability/lethality ballistics methodologies in a server configuration incorporating engineering technologies into higher level models.</li> <li>• -Provide engineering-based predictions of the sub-system capabilities of air and ground combat platforms after multiple impact combinations of direct- and/or indirect-fire threats.</li> <li>• -Develop and demonstrate interaction between untethered and tethered soldiers via DIS in a synthetic environment that includes realistic simulations of physical models of weapons systems, ballistic effects, vehicle systems, and sensor systems..</li> </ul> <p>Total 22642</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>20520</td> <td>21262</td> <td>22260</td> <td>25333</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>21099</td> <td>20328</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-666</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>20433</td> <td>20328</td> <td>20998</td> <td>22642</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1999 funds reprogrammed (-2691) to higher priority requirements.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	20520	21262	22260	25333	Adjustments to Appropriated Value	21099	20328			FY 1998 Pres Bud Request	-666					20433	20328	20998	22642
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE										DATE	PROJECT
2 - Applied Research		0602618A Ballistics Technology										February 1997	AH81
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost		
AH81	Armor/Anti-Armor Technology	6629	4403	4287	4797	4678	5254	5360	5484	Continuing	Continuing		
<p><b>A. Mission Description and Justification:</b> The objective of this project is to provide significantly increased levels of protection and survivability to existing and future combat systems, and to provide significantly increased lethality and effectiveness to existing and future anti-armor munitions by seeking novel and innovative solutions from industry. This project began as a joint program among the U.S. Army, Defense Advanced Research Projects Agency (DARPA), and the U.S. Marine Corps to enhance the national capability in armor/anti-armor (A3) technologies, and has been funded only by the Army since FY 1994. All of the funds in this project are used to fund contractual work to tap innovative ideas of industry. Major contractors include: Dow Chemical Co., Midland, MI; Kaman Sciences, Colorado Springs, CO; Simula Inc., Phoenix, AZ; GDLS, Warren, MI.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>4629 - Developed warheads and penetrators capable of defeating explosive reactive armor.</li> <li>- Performed live fire tests to defeat explosive reactive appliqué target with gun launched kinetic energy (KE) projectiles incorporating KE precursor concepts.</li> <li>- Investigated technical approaches to integration of ballistic protection against overhead attack with signature management technologies.</li> <li>- Initiated development of fuze for active protection system (APS) defeat.</li> <li>- Identified and analyzed existing liquid propellant (LP) technical barriers, prior to design of a high performance LP gun.</li> </ul> <p><b>Total</b> 2000 6629</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2608 - Complete KE precursor concept development for explosive reactive armor (ERA) defeat and down-select final configuration.</li> <li>1695 - Support demonstration of integrated survivability approaches to overhead threats.</li> <li>- Continue development of warhead for APS defeat.</li> <li>100 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p><b>Total</b> 4403</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2622 - Complete KE precursor final design and transition to PE 0603004A, Proj D232, for cartridge integration.</li> <li>- Initiate exploration of novel penetrator designs to defeat advanced armor systems.</li> <li>1665 - Develop integrated top attack and smart armor concepts into lightweight structures employing titanium and other lightweight materials.</li> </ul> <p><b>Total</b> 4287</p> <p>Project AH81</p>													

Exhibit R-2 (PE 0602618A)

Page 8 of 9 Pages



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
AH81

## 2 - Applied Research

## 0602618A Ballistics Technology

## FY 1999 Planned Program:

- 1957 - Continue integration and demonstrate integrated top attack and smart armor concepts into lightweight structures employing titanium and other lightweight materials.
- 2840 - Select and demonstrate novel penetrator designs for full scale testing.
- Initiate design of critical componentry for extended range munitions for tanks.

Total 4797

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
4744	4497	4844	5845
4877	4403		
1752			
6629	4403	4287	4797

Change Summary Explanation: Funding: FY 1996: funds increased (+1885) to support technical efforts to address barriers to the development of a liquid propellant gun.  
 FY 1998: funds reprogrammed (-557) to higher priority requirements.  
 FY 1999: funds reprogrammed (-1048) to higher priority requirements.

Project AH81

Page 9 of 9 Pages

Exhibit R-2 (PE 0602618A)

167

Item 11

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602622A Chemical, Smoke and Equipment								A552	
		Defeating Technology									
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A552	Smoke/Novel Effects Munitions	1728	2259	4739	6691	4167	4231	4314	4411	Continuing	Continuing
<p><b>A. Mission Description and Budget Item Justification:</b> This program element provides exploratory development of technologies to increase survivability with enhanced smoke and obscuring capabilities, and solve critical light force deficiencies to defeat enemy targets (i.e., non-lethal and flame/incendiary devices). Project A552 provides exploratory development of several capabilities essential to counter enemy weapons systems and to provide the overall capability of degrading or defeating the mission of the enemy. Improved multispectral smokes/obscurants will be explored to enhance survivability by providing effective, affordable and efficient screening of deployed forces from threat force surveillance sensors and effective defeat of target acquisition devices, missile guidance, and directed energy weapons, all of which can operate anywhere within the visible through the microwave region of the electromagnetic spectrum. These systems will be designed to be safe and environmentally acceptable. Also under Project A552, flame and incendiary payloads will be developed to defeat a variety of targets ranging from personnel to bunkers and light armored vehicles. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. Efforts under this PE transition and provide risk reduction for Demonstration/Validation and Engineering Development programs. Efforts in this Program Element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1000 -Evaluated degradable and environmentally safe millimeter wave (MMW) screening obscurant candidates; conducted modeling and simulation of MMW screening defeat mechanism; initiated packaging and dissemination studies of candidate degradable MMW material; addressed affordability issues.</li> <li>• 385 -Evaluated novel smoke/obscurant/marketing materials.</li> <li>• 343 -Conducted technical watch level of effort on flame, incendiary, antimateriel, riot control and non-lethal technologies.</li> <li>Total 1728</li> </ul> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1000 -Evaluate degradable and environmentally safe MMW screening obscurant candidates and conduct field trials; conduct packaging and dissemination studies; continue to investigate affordability issues.</li> <li>• 860 -Evaluate rapid obscuration concepts for combat vehicles.</li> <li>• 363 -Conduct technical watch level of effort on flame, incendiary, antimateriel, riot control and non-lethal technologies.</li> <li>• 36 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> <li>Total 2259</li> </ul>											

Project A552

Page 1 of 2 Pages

Exhibit R-2 (PE 0602622A)

168

Item 12

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
A552

## 2 - Applied Research

0602622A Chemical, Smoke and Equipment  
Defeating Technology

## FY 1998 Planned Program:

- 1000 -Evaluate degradable and environmentally safe MMW screening obscurant candidates and conduct field trials; conduct packaging and dissemination studies; continue to investigate affordability issues.
  - 700 -Evaluate rapid obscuration concepts for combat vehicles.
  - 600 -Investigate materials for flame, incendiary, antimateriel, riot control and non-lethal materials.
  - 1783 -Integrate millimeter wave module with the M56 smoke generator and its associated carrier; incorporate mission and operational cost reduction measures.
  - 656 -Investigate candidate infrared screening materials for projectile and light (non-armor) vehicles.
- Total 4739

## FY 1999 Planned Program:

- 2891 -Evaluate rapid obscuration concepts and integrate survivability measures and concepts for armored vehicles.
  - 800 -Investigate new materials for flame, incendiary, anti-materiel and riot control.
  - 2000 -Complete integration of millimeter wave module with the M56 smoke generator; incorporate mission and operational cost reduction measures; conduct field test of system; transition to development.
  - 1000 -Investigate candidate infrared screening materials for projectiles and light (non-armor) vehicles.
- Total 6691

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
1760	2343	2954	3696
1891	2259		
-163			
1728	2259	4739	6691

## Change Summary Explanation:

Funding: FY1998 Congressional plus-up (+1785) for additional efforts on the millimeter wave module and infrared screening materials.  
FY1999 Congressional plus-up (+2995) for additional efforts on the millimeter wave module and infrared screening materials.

Project A552

Page 2 of 2 Pages

Exhibit R-2 (PE 0602622A)

169

Item 12

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602623A Joint Service Small Arms Program								AH21	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH21	Joint Service Small Arms Program	4857	4497	4786	5204	5183	5366	5473	5597	Continuing	Continuing

**A. Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to develop key individual and crew served weapons technologies that will enhance the fighting capabilities and survivability of dismounted battlefield personnel of the Services. This PE funds several efforts including the following: component technology for an Objective Crew-Served Weapon (OCSW) to replace selected M2 machine guns and MK19 grenade machine guns; bursting munitions technology to provide a 300% to 500% increase in hit probability, the ability to defeat defilade or non-visible targets, and means to extend the effective range of the Objective Individual Combat Weapon (OICW) to 1000 meters and the OCSW to 2000 meters; non-conventional target effects (NCTE) technologies for small arms-size directed energy systems (lasers/acoustics/microwaves), increased hit/incapacitation/suppression capabilities with controllable target effects (lethal to less-than-lethal); other fighting technology alternatives (FTA) promoting significant generic advances in function or form of small arms via a spectrum of applications from product improvements through all new weapon concepts (advanced materials and structures for gun systems, guided bullets, and explosively launched projectiles); personal weapon technology leading to a more effective Objective Personal Weapon (immediate incapacitation of body armored personnel out to 50 meters); an objective sniper weapon technology to increase accuracy and effective range to 2000 meters for the next sniper weapon; technology to provide alternative, non-toxic components for small caliber ammunition, to dramatically reduce future environmental contamination during training and enable the Services to comply with applicable statutes; Advanced Medium Machine Gun (AMMG) technology effort to provide a lighter, more effective/versatile system to replace current 7.62mm medium machine guns; and technology efforts leading to improved capabilities for all of the Objective Family of Small Arms. The bursting munition technology development supports the OICW Advanced Technology Demonstration (ATD). All Joint Service Small Arms Program (JSSAP) efforts are based upon approved Joint Service Science and Technology Objectives (JSSTO) and the Joint Service Small Arms Master Plan (JSSAMP), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602624A (Weapons and Munitions Technology), PE 0603607A (Joint Service Small Arms Program), and will transition to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). Additional transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Program Manager (PM) Ground Weapons and US SOCOM. This project includes non-system specific development aimed at specific military needs and therefore is appropriate to Budget Activity 2.

**FY 1996 Accomplishments:**

- 3761 - Developed simulation technology for the OICW.
- Finalized trade-off determination for OCSW.
- Demonstrated critical sub-system component technologies (i.e., bursting munitions, miniature fuzing, enhanced fragmentation, composite weapon/mount components) for OCSW.
- Initiated transition of OCSW technologies for technology demonstration.

Project AH21

Page 1 of 3 Pages

Exhibit R-2 (PE 0602623A)

170

Item 13

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602623A Joint Service Small Arms Program

AH21

## FY 1996 Accomplishments: (continued)

- 714 - Conducted Blue Team technology review/evaluation of Broad Agency Announcement (BAA) Phase I efforts (NCTE; common fuel laser for small arms application; acoustic rifle system; microwave stun gun and FTA; explosively launched projectile; guided bullet; advanced materials and structures for small arms).
- Initiated feasibility demonstration phase for follow-on FTA/NCTE efforts and delivered feasibility demonstration test plan.
- Conducted market survey, reviewed concept proposals and evaluated technologies for non-toxic training ammunition.
- 382 - Initiated technology assessment for new personal and sniper weapons.
- Developed strategy to continuously advance technology for Objective Family of Small Arms.
- Total 4857

## FY 1997 Planned Program:

- 3204 - Initiate integration of Objective Crew-Served Weapon (OCSW) sub-system components into demonstrator design.
- Initiate subsystem technology investigations and front end analysis for an objective sniper weapon.
- 1193 - Fabricate hardware for FY 98 FTA/NCTE feasibility demonstrations.
- Identify technologies for enhancement of Objective Family of Small Arms, focusing on individual and crew weapons.
- Downselect to best initial technology concepts for non-toxic ammunition and perform concept verification.
- 100 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 4497

## FY 1998 Planned Program:

- 2517 - Complete integration of OCSW components into prototype weapon system.
- Initiate integration of OICW fire control technology to OCSW to meet 2000 meter requirement.
- 972 - Complete front end analysis and trade-off determination for an objective sniper weapon.
- 842 - Issue BAA and evaluate innovative concepts for enhancement of Objective Family of Small Arms and initiate competitive component development.
- 455 - Complete FTA/NCTE feasibility demonstration phase and initiate application phase.
- Total 4786

## FY 1999 Planned Program:

- 2715 - Complete OCSW fire control.
- Initiate development of enhanced armor penetration (AP) round for OCSW.
- 1012 - Complete Blue Team review of sniper weapon analysis and initiate component design/demonstration for new sniper weapon.
- 1477 - Complete initial component development of innovative concepts for enhancing the Objective Family of Small Arms
- Total 5204

Project AH21

Page 2 of 3 Pages

Exhibit R-2 (PE 0602623A)

171

Item 13

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)				DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE			PROJECT
2 - Applied Research		0602623A Joint Service Small Arms Program			AH21
<b>B. Project Change Summary</b>		FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget		4975	4593	4722	5092
Appropriated Value		5114	4497		
Adjustments to Appropriated Value		-257			
FY 1998 Pres Bud Request		4857	4497	4786	5204

Project AH21

Page 3 of 3 Pages

Exhibit R-2 (PE 0602623A)

172

Item 13

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602624A Weapons and Munitions Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	24297	22246	25876	30613	31506	33119	33793	34519	Continuing	Continuing
AH18 Artillery & combat Support Technology	10073	9273	11067	12390	12871	13337	13622	13918	Continuing	Continuing
AH19 Close Combat Weaponry	7547	4933	6754	9384	9351	10164	10353	10566	Continuing	Continuing
AH28 Munitions Technology	6677	8040	8055	8571	9284	9618	9818	10035	Continuing	Continuing
AH36 Fuze Technology	0	0	0	268	0	0	0	0	0	268

**Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to develop affordable technologies for advanced direct and indirect fire weapons (except small arms) and munitions. The PE funds several efforts, including the following: advanced weapon concepts and analysis supporting the Rapid Force Projection Initiative (RFPI) demonstration of increased anti-armor capabilities and increased survivability for Early Entry Forces; the Direct Fire Lethality Initiative, by developing technologies to provide upgrade opportunities for fielded ground combat systems. The latter includes: precursor defeat of explosive reactive armor (ERA), advanced composite sabots, in-flight trajectory correction, smart barrel actuators/gearless gun drives, and modeling and analytic codes for thermal analysis and high impetus low flame temperature propellants to reduce wear on gun tubes (which degrades accuracy); high energy explosive technologies that increase projectile and warhead lethality; advanced armament fire control, and decision aids and software architecture; advanced acoustic sensor technology for smart systems, and supports technology advances in anti-armor mine warfare. This PE also funds several additional efforts, including: advanced gun propulsion technologies; shaped charge and explosively formed penetrator warheads and advanced materials for warhead liners and penetrators; advanced fuzes with emphasis on small volume, low cost and countermeasure resistance; area denial concepts; automatic loader and munition transfer mechanisms for large caliber weapons and storage devices; development of demonstration techniques in accordance with Army Battle Lab initiatives and wargame scenarios; and lightweight composite materials in mortar cartridge development. This PE also includes work on thermal management of high performance, high rate of fire, large caliber guns, and advanced air-to-air guns for rotary wing aircraft (e.g., Apache and Comanche). The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. Work in this PE is related to, and fully coordinated with, efforts in PE 0602618A (Ballistics Technology), PE 0602623A (Joint Service Small Arms Program), and transitions to work performed in PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603607A (Joint Service Small Arms Program) and PE 0603802A (Weapons and Munitions Advanced Development). These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

Page 1 of 10 Pages

Exhibit R-2 (PE 0602624A)

173

Item 14

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602624A Weapons and Munitions Technology								AH18	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH18	Artillery & combat Support Technology	10073	9273	11067	12390	12871	13337	13622	13918	Continuing	Continuing

**A. Mission Description and Justification:** This project focuses on the exploratory development of technology for cannon artillery, mortar weapon, fire control and combat support systems. This project funds technology to develop advanced acoustic sensors in support of the RFPI Advanced Concept Technology Demonstration (ACTD). Technology to improve combat vehicles' first round hit probability is being pursued through the development of "smart" barrel actuators and a gearless gun drive concept. Decision aid and software technology is being developed to increase armament battlefield survivability for self-propelled howitzers, along with technologies for improving the effectiveness and affordability of next generation smart munitions. Low Cost Competent Munition (LCCM) concepts integrating Global Positioning System (GPS), fuzing, and possibly guidance and control (G&C) technology are being developed for artillery projectiles. The resulting screw-on module will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the artillery's existing ammunition stockpile. An alternative radar-based projectile tracking system (PTS) is also being pursued. Technology for artillery projectile rotating and obturating bands is being pursued to address an impending shortcoming when firing from high performance cannons. The application of light-weight, high-strength composites to mortar projectiles is being pursued to extend range and, ultimately, enhance target effectiveness. This project also supports pulsed-power technology experiments for electric gun applications and the development and evaluation of advanced area denial concepts as an alternative to anti-personnel mining techniques.

**FY 1996 Accomplishments:**

- 1798 - Completed verification testing of self defense decision aid module; finalized reconnaissance, selection and occupation of position (RSOP) module for Crusader tactics, techniques and procedures (TTP) experiment; completed software tool development and defined viable reuse methods to reduce fire mission software cost and development time by 50%.
- 2172 - Completed M1A1 gearless turret gun drive (GTGD) designed and initiated fabrication study; completed design of 120mm M256 hybrid gun tube for smart barrel actuator integration and test; defined GTGD power consumption characteristics to determine battery power consumption during Silent Watch status.
- 2172 - Defined, through simulation, the optimum configuration of the electric gun and power supply in the Future Combat System (FCS); maintained core research capability in electric gun pulsed power technology.
- 2172 - Refined advanced acoustic sensor (AAS) target vehicle classifier algorithms for integration in the intelligent minefield (IMF); completed AAS miniaturization of prototype hardware in support of the RFPI ACTD.
- 2172 - Provided technical support to the RFPI integrated acoustic sensor (IAS) development and internetted unattended ground sensor (IUGS), successfully tested innovative acoustic wind noise cancellation technique for vehicle application.
- 2283 - Completed mortar fire control system (MFCS) participation in Warrior Focus Advanced Warfighting Experiment (AWE) at Ft. Polk, demonstrating fire mission response times of 1.5 minutes vs. the current six minute standard.

Project AH18

Page 2 of 10 Pages

Exhibit R-2 (PE 0602624A)

174

Item 14

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
AH18  
0602624A Weapons and Munitions Technology

## 2 - Applied Research

## FY 1996 Accomplishments (continued)

- Refined fuzing, payload expulsion and rocket motor designs, and conducted interior ballistic and trajectory analyses for 120mm composite dual purpose improved conventional munition (DPICM) mortar cartridge
- Successfully tested two new composite burster tube materials at 13,000 Gs; gun-fired five high capacity projectile (HICAP) prototypes at Yuma Proving Ground, confirming range predictions and component survivability; finalized obturator design to address projectile body engraving in worn 52 caliber or longer gun tubes; initiated rotating band computer simulations.
- 3820 - Conducted LCCM Phase-1 open-loop canard test at Yuma Proving Ground with successful roll-stabilization; initiated canard and battery re-design for Phase-2; initiated hi-G micro-electro mechanical systems (MEMS) accelerometer study.
- Tracked 155mm projectile trajectories to 24km range/50,000 feet altitude and predicted impact to within ten meters utilizing radar-based projectile tracking system (PTS) at Yuma Proving Ground.

Total 10073

## FY 1997 Planned Program:

- 2272 - Conduct cannon/projectile compatibility Phase I test firing and conduct post-mortem performance evaluation; modify obturator design and fine tune material characteristics.
- Complete gearless gun drive and smart barrel actuator design; fabricate hybrid M256 gun tube.
- Define operational concepts and conduct a requirements feasibility and trade-off analysis of applying software and hardware decision aids components to future armament systems on the digitized battlefield; integrate baseline software architecture description tool into a software test bed and demonstrate the ability to cost effectively support software code development for weapon systems.
- 4651 - Complete auto-registration LCCM GPS translator assembly and test firings; complete projectile impact prediction algorithms; support Advanced Concepts Technology Program (ACT II) closed-loop flight test.
- Refine projectile tracking system (PTS) meteorological extraction algorithms to enable accurate predicted-fire engagements of subsequent missions.
- Continue support of Focused Technology Program (FTP) and Army Research Laboratory efforts in electric armaments planning, management and execution.
- Support Warfighting Experiments between ARDEC and Field Artillery School, Ft. Sill, examining potential First Round Effects on Target concepts to improve artillery effectiveness.
- 2350 - Demonstrate noise cancellation techniques for vehicle mounted acoustic system and continue support to RFPI ACTD.
- Conduct an area intruder detection study using existing sensor nets and define performance parameters; develop the baseline unmanned terrain domination concept as an alternative to conventional anti-personnel mining techniques.
- Define power, data rate and producibility requirements to increase footprint and detection range of a low cost 2nd generation, direct diode laser radar (LADAR) sensor.

Project AH18

Page 3 of 10 Pages

Exhibit R-2 (PE 0602624A)

175

Item 14

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>2 - Applied Research</b>	<b>0602624A Weapons and Munitions Technology</b>	<b>February 1997</b>	<b>AH18</b>
<b>FY 1997 Planned Program: (continued)</b>			
	<ul style="list-style-type: none"> <li>- Initiate fabrication of prototype fuzing, payload expulsion and rocket motor for the 120mm extended range (ER) mortar cartridge.</li> <li>- Collect target acoustic signature data to develop/enhance commander's tactical decision aids in support of integrated acoustic system (RFPI ACTD residual hardware).</li> </ul>		
Total	9273		
<b>FY 1998 Planned Program:</b>			
	<ul style="list-style-type: none"> <li>• 4724 - Conduct system demonstration of auto-registration concept.</li> <li>- Conduct closed-loop flight testing of LCCM self-correcting guidance concepts; dynamically test guidance mechanisms with GPS; flight test gun-hardened GPS components; evaluate MEMS technology for smart munition applications.</li> <li>- Perform projectile tracking system (PTS) operational demonstration and define performance specification.</li> <li>- Evaluate a deployment version of the area denial concept as an alternative to conventional mining techniques; test alternate sensor technologies for personnel detection in realistic environments and lethal and non-lethal defeat mechanisms.</li> <li>• 3255 - Integrate gearless turret drive, smart barrel system, and gearless commander's weapon station (CWS) into M1A1 testbed; complete fabrication of gearless main gun drive; initiate dynamic testing of full-scale smart barrel actuators.</li> <li>- Develop baseline reference architecture software specification for weapon systems; draft architecture process guidelines and baseline reuse components; use software testbed to evaluate the processing of architectures and software component technologies.</li> <li>- Conduct final gun testing of high performance rotating band and obturator designs under worse case conditions (worm-tubes, maximum muzzle velocity); evaluate design performance.</li> <li>- Continue support of RFPI acoustic sensor effort; enhance baseline design of battlefield combat ID (BCID) acoustic sensor system; continue development of acoustic sensor emplacement tools.</li> <li>- Implement/demonstrate on-vehicle acoustic system(s) for counter-fire, counter-sniper and/or situation awareness.</li> <li>• 3088 - Initiate knowledge base and rule development of decision aids utilizing digitized battlefield plans and procedures; initiate integration of the route planning and site selection decision aid modules into the distributed interactive simulation (DIS) environment for the Division Task Force XXI Advanced Warfighting Experiment (AWE).</li> <li>- Conduct simulations in support of Battle Lab AWEs and ARDEC RFPI programs (e.g., intelligent minefield (IMF), precision guided mortar munition (PGMM), and the extended range mortar).</li> <li>- Complete extended range mortar rocket, fuzing and payload deployment designs; complete fabrication of demo hardware and conduct live firing to prove-out rocket motor and payload deployment.</li> <li>- Conduct electric gun technology maturation assessment for program re-transition decision; review/update Future Combat System (FCS) main armament system acquisition strategy.</li> </ul>		
Total	11067		
Project AH18			

Exhibit R-2 (PE 0602624A)

Page 4 of 10 Pages

176

Item 14

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602624A Weapons and Munitions Technology

AH18

## FY 1999 Planned Program:

- 5375 - Integrate miniaturized guidance and control (G&C) system hardware into LCCM self-correcting concept.
- Demonstrate LCCM self-correcting mechanism with GPS utilizing reduced fuze volume; gun fire 155mm projectile to demonstrate MEMS technology survivability and fuzing potential.
- Gather area denial intrusion sensor data in various terrain and weather conditions; develop computer algorithms; conduct simulation to evaluate operational effectiveness.
- 3440 - Continue integration of gearless gun drive into M1A1 testbed; conduct weapon stabilization tests at Aberdeen Proving Ground; transition M1A1 technology to advanced development in support of the Direct Fire Lethality ATD.
- Develop process tools to support a "software component factory" approach to affordable embedded software development; develop repository of reusable fire mission components.
- Conduct demonstration of battlefield combat ID (BCID) acoustic sensor system; conduct demonstration of acoustic sensor emplacement tools for battlefield commanders.
- 3575 - Fabricate brassboard extended range mortar fuze device and gun fire to demonstrate survivability and functioning.
- Complete capture of armament decision aid knowledge base; complete hardware, software and DIS integration efforts; test and verify operation of new decision aid components; initiate man-in-the-loop testing.
- Conduct simulations in support of Battle Lab AWEs and ARDEC RFPI programs (e.g., MOUT, IMF, 105mm TGP, Area Denial).
- Define lightweight mortar design parameters and optimum material candidates; initiate design of key components.

Total 12390

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
11001	9484	11012	11894
11332	9273		
-1259			
10073	9273	11067	12390

Project AH18

Page 5 of 10 Pages

Exhibit R-2 (PE 0602624A)

177

Item 14

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602624A Weapons and Munitions Technology								AH19	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH19	Close Combat Weaponry	7547	4933	6754	9384	9351	10164	10353	10566	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The objective of this project is to exploit and advance new technologies which will demonstrate significant improvements in direct fire weapon performance for ground and air combat vehicles. Principal efforts support the Direct Fire Lethality Program. Included are technologies for the tank projectile precursor defeat of explosive reactive armor (ERA), composites for sabots and gun structures, and trajectory correction mechanisms. In addition, this project develops technologies in the areas of weapon stabilization, projectile design and fabrication, means to increase gun life by reducing barrel wear, thermal management of high rate launch mechanisms and munition auto-loaders, feeders and storage mechanisms. This project provides opportunities for longer range, more accurate and more lethal cannon systems for armored vehicle upgrades (e.g., Abrams, Bradley Fighting Vehicle System (BFVS)) and for future systems. The approach will be to develop both the hardware and analytical tools necessary to assess system performance, identify problem areas and to develop solutions. For FY 1996 only, this project also supported the DoD Non Lethal Munitions program.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>7547 - Gun launched prototype kinetic energy (KE) precursor projectile and tested for structure and function and aerodynamic performance.</li> <li>- Completed structure tests of an enhanced-accuracy kinetic energy projectile.</li> <li>- Conducted acoustic device demonstration; demonstrated ballistic net from 40mm M203 grenade launcher; initiated 40mm non-lethal munitions program; drafted performance specification for 40mm blunt impact munitions; initiated non-lethal vehicle immobilizer and area denial entanglement systems; completed evaluation of non-developmental item muzzle launched ordnance for M16</li> <li>- Completed compact (same stowage as Abrams tank) 120mm autoloader.</li> </ul> <p>Total 7547</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>3740 - Complete KE precursor and axial thruster component prove-out and transition to cartridge integration phase (PE 0603004A/Proj D232).</li> <li>- Deliver compact autoloader for the PM-Abrams integration demonstration.</li> <li>- Apply plasma sputtered deposit of molybdenum/rhenium to worn M256 120mm tank gun tubes and evaluate for barrel life extension.</li> <li>- Apply composite material gun tubes and components to mortar and munition applications.</li> <li>1162 - Initiate acoustic lab demonstration to assess novel target effects for landmine applications (electric and combustion driven sources), continue bio-effects study and testing.</li> <li>- Demonstrate a pre-emplaced, remotely activated, vehicle arresting barrier capable of stopping a wheeled vehicle moving at 48 mph.</li> <li>31 - Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 4933</p> <p>Project AH19</p>											

Exhibit R-2 (PE 0602624A)

Page 6 of 10 Pages

178

Item 14

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>2 - Applied Research</b>	<b>0602624A Weapons and Munitions Technology</b>	<b>AH19</b>																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 6254 - Initiate advanced light gun/ammunition technology improvements for aviation and ground combat vehicles.</li> <li>- Design and evaluate novel penetrators to defeat advanced armors.</li> <li>- Conduct system level trade-offs for target defeat (direct fire and non line of sight)</li> <li>• 500 - Evaluate plasma deposition of molybdenum/rhenium alloy coatings to refurbish worn tank cannon barrels.</li> </ul> <p>Total 6754</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 8884 - Fabricate and test advanced novel penetrator designs.</li> <li>- Develop an ammunition upgrade design concept to meet longer range requirements.</li> <li>- Use distributed interactive simulation to determine overall system performance requirements for dual role air-to-air/air-to-ground weapon system.</li> <li>- Fabricate and demonstrate new method(s) to defeat explosive reactive armor.</li> <li>• 500 - Determine relationships between barrel wear and combustion gas components; adapt unified code to predict wear and erosion of candidate barrel liners and coatings.</li> </ul> <p>Total 9384</p> <p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>4919</td> <td>5389</td> <td>7330</td> <td>8890</td> </tr> <tr> <td>Appropriated Value</td> <td>5057</td> <td>4933</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>+2490</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>7547</td> <td>4933</td> <td>6754</td> <td>9384</td> </tr> </tbody> </table> <p>Change Summary Explanation:</p> <p>Funding: FY 1996 funds increased (+2200) for DoD Non Lethal Weapons program. FY 1999 funds increased (+500) for technology to reduce gun wear and erosion.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	4919	5389	7330	8890	Appropriated Value	5057	4933			Adjustments to Appropriated Value	+2490				FY 1998 Pres Bud Request	7547	4933	6754	9384
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	4919	5389	7330	8890																								
Appropriated Value	5057	4933																										
Adjustments to Appropriated Value	+2490																											
FY 1998 Pres Bud Request	7547	4933	6754	9384																								

Project AH19

Page 7 of 10 Pages

Exhibit R-2 (PE 0602624A)

179

Item 14

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602624A Weapons and Munitions Technology								AH28	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH28	Munitions Technology	6677	8040	8055	8571	9284	9618	9818	10035	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project supports advanced technologies in gun propellants, explosives, warheads, insensitive munitions (IM) and materials for armor penetrators. Advances in warhead technology will provide improved explosively formed penetrators (EFP), shaped charges and heavy metal alloy penetrators and liners to defeat the current and future threat systems. High energy/density explosives are needed to increase lethality. New, improved energetic materials have numerous transition opportunities for weapons system upgrades. The IM efforts conducted in this project will increase the survivability of tanks, artillery, helicopters and infantry fighting vehicles, as well as safety in manufacturing plants, storage depots, and air and sea transport.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"><li>• 2242 - Conducted sensitivity/performance tests and developed process for CL-20 explosive/Trinitroazetadine (TNAZ) formulations.</li><li>- Developed pilot lot process technology for TNAZ explosives and synthesized more highly nitrated cubane explosives.</li><li>• 2122 - Demonstrated advanced EFP anti-armor warhead designs and developed concrete defeat mechanism.</li><li>• 668 - Tested first generation of advanced tungsten composite penetrators (a more environmentally friendly replacement for depleted uranium (DU)).</li><li>• 1645 - Initiated small scale evaluation of high energy gun propellant composition for advanced KE cartridge.</li></ul> <p>Total 6677</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"><li>• 2592 - Conduct warhead testing with advanced CL-20/TNAZ formulations.</li><li>- Demonstrate polynitrocubane synthesis and transition TNAZ for pilot plant processing.</li><li>• 2786 - Demonstrate a high efficiency lightweight concrete defeating warhead.</li><li>• 721 - Initiate 1/4 scale testing of tungsten composite penetrators (a more environmentally friendly replacement for DU in penetrators)</li><li>• 1900 - Scale up pilot plant processing technology of high energy gun propellant.</li><li>• 41 - Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li></ul> <p>Total 8040</p>											
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"><li>• 2611 - Scale up polynitrocubane explosive to pilot plant quantity and initiate study for anti-armor warhead loading.</li><li>• 2950 - Demonstrate selective warhead design to defeat heavy armored targets (15-20% increase in performance over state-of-the-art warheads) or lightly armored targets (four fold increase in lethal area over current shaped charges).</li></ul>											
Project AH28		Page 8 of 10 Pages						Exhibit R-2 (PE 0602624A)			

UNCLASSIFIED



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT		
2 - Applied Research	0602624A Weapons and Munitions Technology		AH28		
FY 1998 Planned Program (continued):					
•	763 - Complete 1/4 scale testing and initiate process scale up for full scale technology demonstration of tungsten penetrators.				
•	1731 - Demonstrate high energy high performance gun propellant in live firings (impetus values 10-20% over JA2 and muzzle velocities 5-10% over M829A2).				
Total	8055				
FY 1999 Planned Program:					
•	2950 - Conduct static warhead test using polynitrocubane explosive to show an increase in energy performance of up to 25%.				
•	3000 - Build on warhead designs demonstrated in FY 1998 to develop advanced warhead concepts to defeat the 21st century threat.				
•	863 - Demonstrate full scale tungsten penetrators.				
•	1758 - Conduct studies on the processibility of thermoplastic elastomers in a twin screw extruder and the effect of binder/plasticizer type and ratio on energetic materials.				
Total	8571				
B. Project Change Summary					
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	
Appropriated Value	7375	8214	8588	9423	
Adjustments to Appropriated Value	7579	8040			
FY 1998 Pres Bud Request	-902				
	6677	8040	8055	8571	

Project AH28

Page 9 of 10 Pages

Exhibit R-2 (PE 0602624A)

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT		
2 - Applied Research		0602624A Weapons and Munitions Technology								AH36		
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost	
AH36	Fuze Technology	0	0	0	268	0	0	0	0	0	268	
<p><b>A. Mission Description and Justification:</b> This project focuses on the applied research of innovative fuzing technologies for ammunition in advanced direct and indirect fire weapons. Fuzing technologies will be investigated that provide the capability to optimize warhead performance and increase lethality against a variety of targets with known and evolving threats, including high performance weapon systems, reactive and active armor, and electronic countermeasures. The principal effort is fuze target sensors. Included in fuze target sensors is the investigation of advanced sensor concepts for proximity fuze applications to include microwave, millimeter wave and laser detection and ranging (LADAR) technologies with emphasis on small volume, low cost designs. This effort will enable the successful launch of a kinetic energy precursor from a tank projectile for defeat of explosively reactive armor. Spin-offs from this exploratory development include fuzing for artillery, mortars, Navy guns, and Air Force high-explosive bombs.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b> Project not funded in FY 97</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 268 - Design and test candidate LADAR signal processing algorithms.</li> <li>- Assemble and test breadboard LADAR fuze.</li> <li>- Investigate candidate millimeter wave front ends.</li> </ul> <p>Total 268</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request 0 0 0 268</p> <p>Change Summary Explanation: Funding: Project established with FY 1999 funds (+268) to focus efforts on advanced fuze technology research.</p>												

Project AH36

Page 10 of 10 Pages

Exhibit R-2 (PE 0602624A)

182

Item 14

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602705A Electronics and Electronic Devices

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	21134	24351	20192	22374	23615	26305	26543	26637	Continuing	Continuing
AH11 Battery/Individual Power Technologies	4266	5946	2218	2415	2404	2488	2537	2593	Continuing	Continuing
AH94 Electronics and Electronic Devices	16868	18405	17974	19959	21211	23817	24006	24244	Continuing	Continuing

**Mission Description and Budget Item Justification:** This program consists of research in the physical sciences essential to all land combat systems that contain electronics, chemical/biological sensors, photonics, magnetic materials, ferroelectrics, microwave and millimeter-wave components, batteries, and fuel cells. Supported systems include the Future Soldier System (FSS), autonomous missile systems, advanced land combat vehicles, smart anti-tank munitions, electric weapons, secure jam-resistant communication, automatic target recognition (ATR), foliage-penetrating radar, combat identification, and digitizing of the battlefield. The work under this program element provides enabling capability to perform precision deep fires against critical mobile and fixed targets, to provide exceptional all-weather, day or night, theater air defense against advanced enemy missiles and aircraft, and to develop small, low-cost, lightweight, high-energy sources of power for communications, target acquisition, miniaturized displays and microclimate cooling for Future Soldier System. Under Defense Reliance agreements, this program supports the in-house exploratory development effort at a single Army site which serves as both the center for display technology development and the center for frequency control and timing for the Army, Navy, Air Force, Ballistic Missile Defense Organization, and Defense Nuclear Agency. It supports all of the science and technology thrust areas that employ electronic and portable power-source technology. This PE includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602705A Electronics and Electronic Devices

AH11

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH11 Battery/Individual Power Technologies	4266	5946	2218	2415	2404	2488	2537	2593	Continuing	Continuing

**A. Mission Description and Justification:** This project provides exploratory development in the application of the physical sciences of electrochemistry, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced battery, fuel cell, and electromechanical (including engines and permanent magnetic alternators) technologies. The goal is to develop small, low-cost, environmentally compatible, light weight, high energy density sources of power for communications, target acquisition, miniaturized displays and combat service support applications, as well as for microclimatic cooling for the Future Soldier System. Technology developments support thrusts aimed at reduced acquisition costs, reduced operations and support costs, and Army modernization. Mobile electric power and fuel cell technology efforts conducted under PE 0602786A/Project AH20 in prior years is restructured to this project beginning in FY 1997. Battery technology conducted under Project AH94 is restructured to this project in FY 1997.

## FY 1996 Accomplishments:

- 2766 - Developed ultra-safe, high performance, rechargeable lithium-ion batteries containing no free metallic lithium.
- Continued development of low cost, high energy, rechargeable alkaline military batteries.
- Continued development of very high energy density, ultra-safe zinc-air batteries.
- 1500 - Tested and evaluated a range of commercial battery chargers/maintainers for extending battery cycle life.
- Total 4266

## FY 1997 Planned Program:

- 895 - Complete design and development of rechargeable lithium ion BA-2590 battery and charger, based on small commercially available cells.
- Demonstrate prototype capacitor-battery hybrid power source for low cost Simulated Area Weapons Effects (SAWE)/Multi Integrated Laser Engagement System (MILES) training missions.
- Continue development of man-portable, hydrocarbon-fueled thermophoto-voltaic power source system.
- 166 - Complete design and fabricate/test essential controls/conditioning/cooling subsystems leading to a complete multi-fuel burning 6 hp engine subsystem. Design/fabricate/test an interim control subsystem for a 3 kW 120 VAC, 60 Hz engine driven generator set. Design/fabricate signature suppressed housing. The design shall include thermal management and user interface considerations.
- 935 - Reduce size and weight of fuel cells, improve thermal management and hydrogen generation techniques.
- 705 - Perform feasibility assessment tasks to demonstrate silent, portable fuel cell systems as a smart battery recharger/power source which can be used by dismounted soldier.
- 1000 - Build, test, demonstrate prototype zinc-air military batteries.
- 750 - Build and test rechargeable alkaline zinc batteries in standard military battery configurations.

Project AH11

Page 2 of 8 Pages

Exhibit R-2 (PE 0602705A)

184

Item 15

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602705A Electronics and Electronic Devices

AH11

## FY 1997 Planned Program (Continued):

- 600 - Continue investigation of effects of no lead added on performance of alkaline cells.
- 750 - Complete development of safe, non metallic lithium rechargeable Fat-D cell for optimum performance BA-2590 training battery.
- 145 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 5946

## FY 1998 Planned Program:

- 940 - Complete development of standard family of lithium manganese dioxide batteries as a more cost effective alternative to the present nonrechargeable lithium sulfur dioxide system for combat missions.
- - Complete development of safe, optimized-performance standard family of rechargeable lithium ion batteries as a lighter weight, lower operations and support cost alternative to the present nickel cadmium and nickel metal hydride batteries.
- - Design and demonstrate a proof-of-principle portable field battery charger based on hydrocarbon fueled thermophoto-voltaic power source system.
- 339 - Complete testing of and demonstrate the lightweight, man portable, signature suppressed, electronically controlled 3.0kW, 120 VAC, 60 Hz engine driven generator set starting/operating on multiple fuels.
- 939 - Demonstrate improved lightweight 50 and 150 watt fuel cell systems with 600 watt-hour capacity.

Total 2218

## FY 1999 Planned Program:

- 1244 - Complete development of an ultra high energy density, low operations and support cost nonrechargeable zinc-air battery system.
- - Fabricate and field test prototype thermophoto-voltaic field battery chargers/portable power sources.
- - Continue design, application, engineering and testing of hybrid power sources to provide smaller, lighter and more cost effective man-portable power systems for C4IEW equipment.
- 528 - Initiate design of a 350 pound portable, electronically controlled engine-driven generator set capable of providing 5 kW 120 VAC, 60 Hz and operating on multiple fuels for tactically mobile use. Initiate fabrication/procurement of the power components and subsystems.
- 643 - Design liquid fueled 50 - 150 watt fuel cell with 2000 watt-hour.

Total 2415

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2877	2123	2271	1887
4500	5946		
-234			
4266	5946	2218	2415

Project AH11

Page 3 of 8 Pages

Exhibit R-2 (PE 0602705A)

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b> February 1997
<b>BUDGET ACTIVITY</b> 2 - Applied Research	<b>PE NUMBER AND TITLE</b> 0602705A Electronics and Electronic Devices	<b>PROJECT</b> AH11

Change Summary Explanation: Funding: FY 1996: Congressional interest add to evaluate/test a charger/maintainer capability to extend battery cycle life.  
FY 1997: Congressional interest add (+3950) to evaluate additional battery and fuel cell technologies.  
FY 1999: Project funding increased (+520) to fund advanced lightweight portable power system, a science and technology objective.



## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602705A Electronics and Electronic Devices

PROJECT

AH94

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH94 Electronics and Electronic Devices	16868	18405	17974	19959	21211	23817	24006	24244	Continuing	Continuing

**A. Mission Description and Justification:** This project provides exploratory development in the application of the physical sciences of physics, electrochemistry, biotechnology, electronics, and process science, as they apply to improving existing systems and enabling newer, more advanced systems. Technology developments support thrusts aimed at reduced acquisition cost, reduced operations and support costs, Army modernization, Advanced Technology Demonstrations and Advanced Technology Transition Demonstrations, described in the Army Science and Technology Master Plan.

## FY 1996 Accomplishments:

- 8337 - Demonstrated an electronic component design tool featuring a behavioral accelerator for architectural assessment/optimization. Investigated integration of microwave (MW)/analog/digital design tools into a single hardware description language (HDL).
- Designed and fabricated advanced microwave/millimeter microwave components to enable line of sight space and terrestrial communications, Battlefield Combat Identification System for the dismounted soldier, and moving target indicator (MTI) radar Advanced Technology Demonstration. Developed sub-millimeter wave (MMW)/terahertz components to enable ammo devices operating at frequencies where detection, interference, and countermeasures are inhibited.
- Designed and fabricated new oscillator technologies based on micromachined silicon, quartz, and piezoelectric thin-film resonators as well as new piezoelectric materials such as langasite and lithium tetraborate for components for Army land combat command and control situations.
- 5686 - Exploited improved processing technologies to fabricate miniature sensors/actuators for mine detection, hand-held optoelectronic biosensors, and missile seekers. Developed a biochemical sensor system to determine the feasibility of coupling mechanisms critical to biosensor development.
- Improved fabrication processes based on phosphor physics and luminescence properties to develop and demonstrate ruggedized, high resolution, low power, flat panel and head-mounted displays for command post situations, personal communications, and training applications. Investigated reliability issues and commercial practices.
- Synthesized/evaluated novel fluorinated carbon cathode material for future primary lithium battery with energy density greater than 200 W hr/kg; developed high energy/power density LiMnO<sub>2</sub> pouch battery for the 21st Century Land warrior (21CLW).
- 2845 - Demonstrated low temperature heteroepitaxial growth for circuit integration; continued modeling of nonlinear optical processes for optical oscillators/amplifiers and improvement of zinc germanium phosphide material.
- Demonstrated a massively parallel, scaleable processor in an architecture of sufficient throughput to support real-time 3-D visualization of terrain and battlefield information across distributed computing environments.

Total 16868

Project AH94

Page 5 of 8 Pages

Exhibit R-2 (PE 0602705A)

187

Item 15



UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		<b>DATE</b>	<b>February 1997</b>
<b>BUDGET ACTIVITY</b>	<b>PE NUMBER AND TITLE</b>	<b>PROJECT</b>	
<b>2 - Applied Research</b>	<b>0602705A Electronics and Electronic Devices</b>	<b>AH94</b>	

  

<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 10125 - Improve integrated computer-aided design technologies and apply to electronic components to achieve a 4x reduction in time and cost to develop/upgrade high performance devices, components, sensors and process modules for Army land combat systems.</li> <li>- Continue effort to design and fabricate advanced MW/MMW/quasi-optical components to improve line-of-sight space and terrestrial communications and fire control applications. Design and prototype sub-MMW/terahertz components to enable communication devices to operate at frequencies where detection, interference, and countermeasures are inhibited.</li> <li>- Develop and characterize new piezoelectric materials and novel resonators and microresonators for low noise oscillators and high-accuracy clock applications. Develop high-accuracy, low-noise, low-power quartz and atomic clocks and resonant sensors for uncooled infrared, chemical and acceleration sensing.</li> <li>• 3882 - Design, fabricate, and transition improved miniature sensors/actuators for mine detection and missile seekers. Develop hand-held optoelectronic biosensors to provide new and critically needed capabilities in biological/chemical warfare agent detection for the warfighter.</li> <li>- Apply improved fabrication processes based on phosphor physics and luminescence properties to emerging display technologies and demonstrate ruggedized, high resolution, low power, flat panel displays for command post situations, personnel communications, and training applications.</li> <li>- Jointly evaluate with Air Force high temperature super conducting (HTSC) antenna feed for Military Strategic Tactical Relay System (MILSTAR); demonstrate and integrate MMW devices into MTI radar.</li> <li>• 4225 - Prototype lithium cells utilizing highly energetic oxyhalide and transition metal oxide cathode materials; demonstrate proof-of-principle thermophotovoltaic power source for quiet mobile electric power field generators.</li> <li>- Continue investigation of nonlinear optical processes; investigate additional materials; extend modeling of nonlinear processes; optimize mid-IR optical parametric oscillator (OPO).</li> <li>- Develop a prototype to validate scalability of processors and architectures from combat platforms to mobile command nodes. Transition technology to Battlespace C2 ATD.</li> <li>173 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 18405</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 5180 - Fabricate and evaluate ferroelectric thin-film millimeter wave scanning antenna and advanced ferroelectric lenses to demonstrate electronic scanning.</li> <li>- Demonstrate MW/MMW/terahertz devices for communications/navigation/surveillance systems.</li> <li>- Develop predictive physics-based and circuit-based modeling and simulation tools for microwave circuits, leveraging high performance computing assets.</li> <li>- Develop a bio-acoustic wave sensor based on binding reactions to detect toxic protein, viruses, and bacteria.</li> </ul>	<p>Exhibit R-2 (PE 0602705A)</p>
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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602705A Electronics and Electronic Devices

AH94

## FY 1998 Planned Program: (continued)

- 6133 -Design and fabricate optoelectronic devices for secure, spread spectrum communications systems and high efficiency power switches for use in foliage/ground penetrating ultra-wide band radar applications.
- Complete material property studies and optimize process technology for lead zirconate titanate (PZT) thin-films for use in microactuators and microsensor devices.
- Develop high luminous efficacy phosphors and devices, circuitry and drivers for various display technologies, and perform characterization of these displays.
- 3234 -Execute DoD-mandated program to maintain industrial base in oscillator and clock technology.
- Develop low-noise, acceleration-insensitive oscillator technology for air-borne navigation and communication systems such as J-STARS.
- Develop low-power, high-accuracy clock technology to support direct P-code acquisition of global positioning system (GPS) as well as a high-shock version for GPS guided munitions.
- 1459 -Leverage DARPA funded program to develop a 20kW, 500kJ 144V prototype capacitor. Continue efforts to improve technology for lightweight hydrogen and methanol fueled backpack fuel cell.
- Investigate new cathodic electrocatalysts for man-portable methanol fuel cells and prototype rechargeable Li cells with solid electrolyte to develop low-cost, high-energy density power sources.
- Improve the design and construction of reserve battery technology and demonstrate the feasibility of a 90 second operating lifetime.
- 702 -Investigate techniques to parallelize algorithms for transformation and rendering the information elements that are part of the battle scene which will be compatible with the next generation of tactical parallel and scalable processing architectures.
- 1266 -Fabricate mercury cadmium telluride detector array on silicon substrate.
- Demonstrate 8 micron laser source by OPO and characterize parameters relevant for remote chemical detection.

Total

17974

## FY 1999 Planned Program:

- 4890 -Design and fabricate high frequency electronic components including antennas, ferroelectric materials/devices, transmit/receive modules, and MW/MMW devices to improve soldier situational awareness by enhancing the senses through communications, radar, electronic warfare (EW), surveillance, and target acquisition systems.
- Develop scalable software to predict performance, cost, and other parameters of electronic components without producing hardware.
- Demonstrate simulation models for power semiconductors, HDL, and electromagnetic solvers for high frequency circuit design to reduce procurement time and costs of high frequency electronic components.
- 4318 -Execute DoD-mandated program to support industrial base for research on low-noise, acceleration-insensitive oscillator technology and low-power, high-accuracy, high-shock clocks for communication/navigation systems.

Project AH94

Page 7 of 8 Pages

Exhibit R-2 (PE 0602705A)

189

Item 15

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
2 - Applied Research	0602705A Electronics and Electronic Devices	AH94																										
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>6981 -Advance the state-of-the-art of GaAs quantum well technology to support manufacturable, low-cost, high-performance devices for missile seeker applications.</li> <li>-Continue to improve optoelectronic device design, fabrication, and characterization processes for high speed communications and target acquisition/surveillance.</li> <li>-Leverage DARPA programs to continue advanced displays research on phosphors, interface circuitry, and manufacturing processes to eventually achieve luminous efficacy of 80 lumens/Watt.</li> <li>-Develop a tapered fiber-optic biosensor based on fluorescent evanescent wave detection to target toxic small and large molecules and particles (endotoxins, oligonucleotides, viruses, cells, and fragments).</li> <li>1695 -Research and develop electrode and electrolyte materials to enable advanced energy storage devices and electrochemical capacitors for portable communications systems.</li> <li>-Continue to improve reserve technology for smaller, longer-lived, higher power-density devices capable of surviving high-spin, high "g" environments for smart mines and fuses.</li> <li>730 -Demonstrate a parallelized battlespace visualization suit of algorithms on a next generation tactical processing architecture.</li> <li>1345 -Demonstrate high quality electro-optic devices monolithically integrated with silicon electronic devices.</li> <li>Total 19959</li> </ul>																												
<p><b>B. Project Change Summary</b></p> <table border="0"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>17051</td> <td>18799</td> <td>19207</td> <td>21940</td> </tr> <tr> <td>Appropriated Value</td> <td>17525</td> <td>18405</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-657</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>16868</td> <td>18405</td> <td>17974</td> <td>19959</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1998 funds reprogrammed (-1233) to higher priority requirements.  FY 1999 funds reprogrammed (-1981) to higher priority requirements.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	17051	18799	19207	21940	Appropriated Value	17525	18405			Adjustments to Appropriated Value	-657				FY 1998 Pres Bud Request	16868	18405	17974	19959
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	17051	18799	19207	21940																								
Appropriated Value	17525	18405																										
Adjustments to Appropriated Value	-657																											
FY 1998 Pres Bud Request	16868	18405	17974	19959																								

Project AH94

Page 8 of 8 Pages

Exhibit R-2 (PE 0602705A)

190

Item 15

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997									
PROJECT DH95									
PE NUMBER AND TITLE									
0602709A Night Vision Technology									
BUDGET ACTIVITY									
2 - Applied Research									
COST (In Thousands)									
FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
16442	16636	17304	19213	19183	19872	20287	20744	Continuing	Continuing

**A. Mission Description Item Justification:** This project develops core night vision and electronic sensor technologies for Army weapons systems. Advanced focal plane arrays, both infrared and multispectral, are being developed that will see farther, provide advanced signal processing, and improve performance on the dirty battlefield. Lightweight, high resolution common module optics and sensor technologies for future head-mounted vision systems are being developed for future aviators, infantry, armored vehicle crewmen, and field maintenance personnel. Multiwavelength, multifunction laser sources will provide affordable, high performance technology options for Army tactical laser rangefinding, designating, obstacle avoidance, biological agent detection, laser radar, and missile countermeasures. Automatic target recognition technologies will enable dramatic reductions in the time to acquire targets, detect land mines, and collect intelligence data while also reducing the warfighter's cognitive workload. Hardware-in-the-loop multispectral sensor simulations are being developed that will allow end-to-end predictive modeling, hardware design, and evaluation of new technologies in a virtual environment, while allowing warfighters to test these capabilities, develop tactics and techniques, and train in parallel with the hardware development process. This program element supports Force XXI Soldier, upgrades for Force XXI weapons systems, Army After Next future systems, as well as the Rapid Counter Multiple Rocket Launcher, Rapid Force Projection Initiative (RFPI), and Rapid Battlefield Visualization Advanced Concept Technology Demonstrations (ACTDs). Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri Service Reliance Agreements on Sensors and Electronic Devices. Work in this program element is related to and fully coordinated with PE 0602712A (Counterintelligence Technology), PE 0602270A (Electronic Warfare Technology), and PE 0603710A (Night Vision Advanced Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting applied research and tests of general technologies to meet specific military needs and is correctly placed in Budget Activity 2.

**FY 1996 Accomplishments:**

- 6420 - Completed thermal scene rendering capability for virtual imagery, provided data base for simulated night scene to the Dismounted Battlespace Battle Lab and validated representation of low observable target models in electronic terrain board system.
- Conducted comparative evaluation of candidate automatic target recognition (ATR) algorithms for Hunter Sensor Suite, established beta site for rapid application specific sensor processing (RASSP) and conducted architecture analysis, using high density multi chip modules for Reconnaissance, Surveillance, and Target Acquisition Aided Target Recognition (RSTA ATR) applications.
- 6904 - Demonstrated fabrication of 128x128 staring detector array with on chip analog to digital conversion using molecular beam epitaxial (MOMBE) microfactory, continued evaluation of staring focal plane arrays (FPAs) for imaging applications and established performance metrics and preliminary performance models.
- 3118 - Completed design trade-offs for objective and ocular optics for common helmet mounted vision system (HMVS) and demonstrated binary optics hybrid for potential cost/weight reductions.

Project DH95

Page 1 of 3 Pages

Exhibit R-2 (PE 0602709A)

191

Item 16

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602709A Night Vision Technology</b>	<b>DH95</b>	
<b>FY 1996 Accomplishments: (continued)</b>			
- Conducted laboratory demonstrations of optical parametric oscillator (OPO) techniques to generate multiple wavelengths in the 1-5 micron region for multiple laser applications, and initiated development of multifunctional control software.			
Total	16442		
<b>FY 1997 Planned Program:</b>			
•	5386	- Evaluate staring focal plane performance against preliminary model; refine modeling capability and staring focal plane array metrics and assess producibility; demonstrate readout integrated circuits for non-uniformity correction, image enhancement and dynamic range control for advanced focal plane arrays.	
•	4367	- Develop core display electronics and sensor technologies for multiple HMVS applications and fabricate advanced optic components for demonstration.	
		- Demonstrate multifunction laser control software for rangefinding, designating, and profiling and burst-mode eyesafe laser technology. Initiate producibility/affordability program.	
•	6772	- Extend ATR evaluation capability to millimeter wave (MMW) radar applications; assess improvements in search effectiveness and target acquisition when gunner or image analyst is aided with ATR; demonstrate tank cue using commercial off the shelf (COTS) software / high density multi chip module.	
		- Demonstrate virtual scene simulation, integrated with realistic terrain and cultural features, shadowing, diurnal cycle effects, and near infrared image intensifier simulation.	
		- Initiate development of synthetic mine signatures and support development of evaluation methodology for aided mine detection algorithms.	
•	111	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.	
Total	16636		
<b>FY 1998 Planned Program:</b>			
•	4993	- Evaluate the practicality and affordability of large single spectrum staring/scanning arrays along with validated imager performance models for transition to high sensitivity integrated detector/dewar demonstration; and demonstrate smart on-chip functions such as spatial and temporal filtering.	
•	1420	- Develop compact fundamental laser module and wavelength conversion modules that can be combined as needed for different applications such as target designation, eyesafe rangefinding, laser radar, and chemical detection.	
•	7591	- Integrate advanced FLIR/ MMW radar ATR evaluation capability for multi-sensor RSTA applications; incorporate low power, miniaturized high performance components into ATR hardware for compact applications.	
		- Initiate development of real-time multi-spectral (0.4 to 14 microns) scene-rendering capability for insertion into prototyping and wargame simulations.	
		- Support development of synthetic mine signatures and evaluation of aided mine detection algorithms.	

Project DH95

Page 2 of 3 Pages

Exhibit R-2 (PE 0602709A)

192

Item 16

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602709A Night Vision Technology

DH95

## FY 1998 Planned Program: (continued)

- 3300 - Initiate development of a low cost solid state near IR focal plane with spectral sensitivities from 0.2 micron to 1.8 micron as a high resolution, lightweight replacement to image intensifier tubes.

Total 17304

## FY 1999 Planned Program:

- 5487 - Demonstrate multispectral sensing and partition smart functions between on- and off-focal plane processing, and demonstrate analog to digital and multi-band fusion processing on the focal plane.
- 1570 - Demonstrate multiwavelength laser modules for common source for multi-function and multi-application lasers.
- 7856 - Conduct ATR evaluations of multispectral and large format staring IR sensors in increasingly complex dynamic operational scenarios, and integrate off focal plane ATR processing with smart focal plane array.
- 4300 - Demonstrate a real-time multi-spectral scene rendering (0.4 to 14 microns) capability in a wargame simulation.
- 4300 - Provide mine signature simulation and aided mine detection evaluation support to land mine center of excellence.
- 4300 - Demonstrate a low cost solid state near IR camera with superior sensitivity to present I<sup>2</sup> tubes for multispectral applications from UV, visible, to near IR.

Total 19213

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
16624	16994	17842	19143
17086	16636		
-664			
16442	16636	17304	19213

Project DH95

Page 3 of 3 Pages

Exhibit R-2 (PE 0602709A)

193

Item 16

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602712A Countermine Applied Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	0	7372	10598	10715	10485	10574	10781	11020	Continuing	Continuing
AH24 Countermine Technology	0	6041	9448	8301	8324	8088	8243	8422	Continuing	Continuing
AH35 Camouflage Technology	0	0	799	2058	2161	2486	2538	2598	Continuing	Continuing
AC61 TRACTOR QUAKE	0	1331	351	356	0	0	0	0	0	2038

**Mission Description and Budget Item Justification:** This program element provides countermine and advanced signature management technologies. The specific countermine efforts include remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotics technologies will be emphasized to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. A Center of Excellence for land mine detection will coordinate and standardize development of mine signature simulations, provide a catalogue of mine signatures, and support evaluation of aided mine detection algorithms. Advanced signature management techniques will provide mobile and semi-mobile assets (e.g., Abrams, Theater Missile Defense) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weapons and ground vehicles. Work in this program element is related to and fully coordinated with PE0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), and PE0603710A (Night Vision Advanced Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting applied research and tests of general technologies to meet specific military needs and is therefore correctly placed in Budget Activity 2.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602712A Countermine Applied Research								AH24	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH24	Countermine Technology	0	6041	9448	8301	8324	8088	8243	8422	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> Countermine research will focus on remote detection of minefields, and detection and neutralization of individual mines from moving vehicles and manportable systems. Advanced robotics technologies will be developed to minimize threats to weapons systems and personnel. Breaching and neutralization techniques will be developed for both conventional and electronically activated mines that can act at a distance. A Center of Excellence for land mine detection will coordinate and standardize development of mine signature simulations, provide a catalogue of mine signatures, and support evaluation of aided mine detection algorithms. Advanced signature management techniques will provide mobile and semi-mobile assets (e.g., Abrams, Theater Missile Defense) with low cost, low burden survivability enhancements addressing detection avoidance and hit avoidance in global battlefield conditions. Efforts for camouflage technologies are restructured to Project AH35 of this PE beginning in FY 1998.</p> <p><b>FY 1996 Accomplishments:</b> Funded in PE 0602786A (Logistics Technology), AH20.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 660 - Demonstrate passive low observable/deception technologies for suppression of mobile and semi-mobile assets' multispectral signatures, reducing detection ranges by 50 percent in woodland, desert, arctic and urban battlefield environments.</li> <li>• 4010 - Evaluate imaging infrared (IR) and frequency agile radar for application to the Mine Hunter Killer; fabricate and integrate directed energy brassboard system.</li> <li>• 1224 - Evaluate underpinning enhancements to forward looking radar and determine technical performance parameters required to achieve probability of detection of 98% with a false alarm rate of &lt;0.2 per meter of forward progress.</li> <li>• 147 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 6041</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 7961 - Investigate a variety of new component and focal plane array (FPA) technologies, such as 3-5 micron staring FPAs, multi/hyperspectral, passive polarization active sources and electronic stabilization to support a lightweight, airborne stand-off mine detection capability for limited area (point) detection.</li> <li>- Evaluate advanced IR, passive millimeter wave, and ultra-wide band radar technologies to significantly extend standoff detection ranges against antitank mines.</li> <li>- Complete design of an explosive neutralizer as part of the Mine Hunter/Killer.</li> </ul>											

Project AH24

Page 2 of 4 Pages

Exhibit R-2 (PE 0602712A)

195

Item 17

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																	
<b>2 - Applied Research</b>	<b>0602712A Countermine Applied Research</b>	<b>AH24</b>																	
<p><b>FY 1998 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>1487 - Initiate development of mine signature simulations, initiate database of mine signatures, and establish methodology for evaluation of aided detection algorithms in support of land mine detection Center of Excellence.</li> </ul> <p>Total 9448</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>7817 - Complete study efforts and initiate critical component development for the lightweight, airborne stand-off mine detection technology demonstration for limited area (point) detection and the detection of mines on major supply routes.             <ul style="list-style-type: none"> <li>- Investigate acoustic and seismic technologies as an additional means of enhancing the ability to remotely detect mines at speeds of 5-20 km/hr.</li> <li>- Complete enhancements to advanced mine detection sensors, integrate sensors, and conduct static testing as part of the Mine Hunter/Killer.</li> <li>- Continue development of mine signature simulations, cataloging of mine signatures, and assessments of aided mine detection algorithms in support of land mine detection center of excellence.</li> </ul> </li> </ul> <p>Total 8301</p> <p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4670</td> <td>6263</td> <td>7384</td> </tr> <tr> <td></td> <td>6041</td> <td></td> <td></td> </tr> <tr> <td>0</td> <td>6041</td> <td>9448</td> <td>8301</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding- FY1997 (+1371) Congressional increase.  FY 1998 (+3185)/ FY 1999 (+917)- Funding increased to address high priority requirements for mine detection and neutralization.</p>				FY 1996	FY 1997	FY 1998	FY 1999	0	4670	6263	7384		6041			0	6041	9448	8301
FY 1996	FY 1997	FY 1998	FY 1999																
0	4670	6263	7384																
	6041																		
0	6041	9448	8301																

Project AH24

Page 3 of 4 Pages

Exhibit R-2 (PE 0602712A)

196

Item 17

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0602712A Countermine Applied Research

PROJECT  
AH35

## 2 - Applied Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH35 Camouflage Technology	0	0	799	2058	2161	2486	2538	2598	Continuing	Continuing

**A. Mission Description and Justification:** Develop signature management and deception technologies that deny acquisition of friendly force assets from threat sensors. Demonstrations will be supported by signature characterization, modeling and simulation conducted under the Integrated Sensor Modeling and Simulation effort. These signature management and deception systems provide mobile and semi-mobile assets with low cost, low operational burden survivability upgrades addressing detection avoidance in global battlefield conditions. This project is a restructure from project AH24.

**FY 1996 Accomplishments:** Funded in PE 0602786A (Logistics Technology), AH20.

**FY 1997 Planned Program:** Funded in project AH24 of this PE.

**FY 1998 Planned Program:**

- 799 - Complete feasibility studies for advanced camouflage and deception technologies.
- Develop and demonstrate passive IR coatings for signature suppression of vehicles.

Total 799

**FY 1999 Planned Program:**

- 2058 - Develop reactive IR suppressive coatings.
- Develop appliques/structures to reduce vehicle and solar loading signatures over an extended period of a diurnal cycle and in varying backgrounds.
- Develop electronically projected, multispectral decoy to replicate the signature of a combat vehicle.

Total 2058

**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

	FY 1996	FY 1997	FY 1998	FY 1999
	0	0	0	0
	0	0	799	2058

Change Summary Explanation: Funding: This project is a restructure of funds beginning in FY 1998 to highlight camouflage research activities.

Project AH35

Page 4 of 4 Pages

Exhibit R-2 (PE 0602712A)

197

Item 17

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

2 - Applied Research

PE NUMBER AND TITLE

0602716A Human Factors Engineering  
Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	15445	15968	14256	15626	14149	14275	14687	15171	Continuing	Continuing
AH34 Rural Health Technology	3319	2203	0	0	0	0	0	0	0	5522
AH70 Human Factors Engineering Systems Development	12126	13765	14256	15626	14149	14275	14687	15171	Continuing	Continuing

**Mission Description and Budget Item Justification:** The objectives of this program are, first, to maximize the effectiveness of soldiers in concert with their materiel so that they may survive and prevail on the battlefield. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of soldiers, with particular attention on soldier and equipment interaction. Secondly, this project focuses on improving health care in remote areas through research and technology development in distance learning and professional collaboration (teleconsulting and telepracticing). The work in this latter effort complements related Army programs in soldier performance, training and evaluation methodologies, and will provide direct research benefits to the Army's medical community, including combat casualty care on the battlefield and in other remote areas of operation. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. All work under this PE is part of the Human Systems Tri-Service Reliance panel. These projects include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602716A Human Factors Engineering  
Technology

PROJECT

AH34

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH34 Rural Health Technology	3319	2203	0	0	0	0	0	0	0	5522

**A. Mission Description and Justification:** This project focuses on improving health care in remote areas through research and technology development in distance learning. The objectives are: (1) identify the best practices in remote training and education, and (2) demonstrate the value of selected strategies, technologies and methodologies. This project is performed by Saint Francis College in Loretto, Pennsylvania and its Center of Excellence for Remote and Medically Under-Served Areas (CERMUSA), with technical oversight and coordination by the Naval School of Health Sciences. Funds were forwarded to the Navy for program execution.

The FY97 Congressionally-mandated program provides for the continued development, field testing, and empirical validation of methods for improving the coordinated functioning of emergency medical teams (both military and civilian). This multi-year project, initiated at the direction of the Army Chief of Staff in FY94 and supported by Congress in FY96, extends previous Army research on the effective training and evaluation of military aviation crews and systematically applies it to the collection of hospital and pre-hospital personnel who must perform as an effective team during the initial "golden hour" of shock/trauma or acute patient care. Additionally, this project provides both the civilian and military medical communities with a rigorous framework for objectively demonstrating and assessing the "value-added" of selected telemedicine and medical decision management technologies.

**FY 1996 Accomplishments:**

- 3319 - Developed and demonstrated distance learning technologies for: (1) increasing specific health care provider skills and education, and (2) linking providers to innovative distance learning modalities, such as short term continuing education units, community-based wellness education, school-based health programs, and Masters of Medical Science remote education and Internet sources.

Total

3319

**FY 1997 Planned Program:**

- 2149 -Complete development of prototype team training and evaluation packages for emergency medicine (Madigan Army Medical Center and Rhode Island Hospital).
  - Identify military and civilian hospital sites for field validation of training and evaluation packages (eight hospitals to be determined).
  - Conduct comparative investigations of teleconsulting versus on-site decision aids for field intubation of trauma patients (Univ of Maryland Shock Trauma Center).
  - Initial examination of patient simulator technology for "value added" to emergency medical team performance.
  - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

54

Total

2203

Project AH34

Page 2 of 7 Pages

Exhibit R-2 (PE 0602716A)

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602716A Human Factors Engineering Technology	AH34	
FY 1998 Planned Program: Project not funded in FY 98.			
FY 1999 Planned Program: Project not funded in FY 99.			
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	3405	0	0
Adjustments to Appropriated Value	3500	2203	
FY 1998 Pres Bud Request	-181		
	3319	2203	0
Change Summary Explanation: Funding: FY 1997 funding provided by Congress (+2203) to evaluate human factors in emergency medical teams.			

Project AH34

Page 3 of 7 Pages

Exhibit R-2 (PE 0602716A)

200

Item 18

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602716A Human Factors Engineering  
Technology

PROJECT

AH70

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH70 Human Factors Engineering Systems Development	12126	13765	14256	15626	14149	14275	14687	15171	Continuing	Continuing

**A. Mission Description and Justification:** This program focuses on maximizing the effectiveness of the soldier in concert with his materiel, in order to survive and prevail on the battlefield. The 21st Century Land Warrior (21CLW) program is directly supported by this soldier-system performance and supportability enhancement program. Specialized laboratory studies and field evaluations are conducted to collect performance data on the capabilities and limitations of soldiers, with particular attention on soldier and equipment interaction. The resulting data are the basis for weapon systems and equipment design standards, guidelines, handbooks and soldier training and manpower requirements to improve equipment operation and maintenance. Application of advancements yields reduced workload, fewer errors, enhanced soldier protection, user acceptance, and allows the soldier to extract the maximum performance from the equipment.

**FY 1996 Accomplishments:**

- 3579 - Developed operational prototype of information exploration tool, including operational prototype of the management of the multitude of assumptions made by the user (ASSUMPTION MANAGER), and interactive logistics planning prototype with automated graphics generation.
  - Collected performance data on sensor-human feedback interface devices, exoskeleton control devices for human positioning and monitoring and multi degree of freedom force sensors. Completed advanced armored vehicle technology (AAVT) study on armor vehicle containerization. Continued the palletized loading system container lift kit study.
  - Improved the auditory detection model (ADM) through localization and impulse noise detection.
  - Conducted performance research to evaluate advanced controls and displays for a force "on the move" in adverse environments.
- 6850 - Completed input of latest anthropometric data and added the capability for surface mapping, simulated uniforms and basic equipment restrictions to the human figure performance model (JACK).
  - Developed Improved Performance Research Integration Tool (IMPRINT), version 1.0, accreditation review report. Developed IMPRINT version 2.0, with full-scale analysis and process-linked capability. Developed trade-off tool to assess effects of available manpower and personnel characteristics on system redesign options, and validated tool with human factors engineering field data.
  - Continued efforts to develop a simulation capability for the individual soldier fighting system in a distributed interactive simulation (DIS) environment through the use of virtual reality and synthetic environment technologies.
  - Continued enhanced human factors engineering field evaluation methods with soldier-in-the-loop operational test exercise data to upgrade capabilities to assess new technologies and systems.

Project AH70

Page 4 of 7 Pages

Exhibit R-2 (PE 0602716A)

201

Item 18

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602716A Human Factors Engineering  
Technology

AH70

## FY 1996 Accomplishments: (continued)

- 1697 - Provided human factors engineering (HFE) support to AMC, AMC RDEC installations, Training and Doctrine Command (TRADOC), battle labs and laboratories.
- Initiated development of soldier-information system performance metrics for the digitized battlefield.

Total 12126

## FY 1997 Planned Program:

- 4598 - Within the knowledge-based logistics planning shell (KBLPS) tool framework, demonstrate mechanisms for constructing, automatically updating and interactively presenting multi-media staff briefings, incorporating large quantities of complex information for command and control and logistics.
- Develop forklift enhancement data on International Standard Organization (ISO) container unstuffing to validate operator interface improvements.
- Investigate control and operator sensing strategies and configurations for teleoperated manipulator devices doing military tasks. Complete development and evaluation of the automated field material handling workcell concept.
- Continue efforts to collect performance data on sensor human feedback interface devices and exoskeleton control devices. Research focus will be on lightening the soldier's load, focusing primarily on fatigue reduction.
- Incorporate auditory performance parameters into metrics to enhance soldier survivability.
- Conduct simulations in a distributed interactive simulation (DIS) environment for decision making by a dispersed force.
- 3332 - Demonstrate and distribute human figure performance model (JACK) Army wide.
- Complete Improved Performance Research Integration Tool (IMPRINT), version 2.0 accreditation review report and continue efforts to develop trade-off tools to evaluate soldier and unit performance and life cycle cost implications of choices in concept and system designs.
- Continue efforts to develop and deliver a virtual reality (VR) capability for the individual soldier fighting system in a DIS environment through the use of VR and synthetic environment technologies, e.g., high resolution visual displays, computer image generators, 3-D audio, etc.
- 5791 - Evaluate and validate soldier-system analysis tools in an operational environment and evaluate new system concepts, e.g., battle command vehicle.
- Provide HFE support to AMC, AMC RDEC installations, Training and Doctrine Command (TRADOC), battle labs and laboratories.
- Develop a draft Army standard set of soldier-information system performance metrics and demonstrate in the context of Task Force 97.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 44 13765

## FY 1998 Planned Program:

- 4791 - Refine and enhance interactive logistics planning tools for integration into Logistics Anchor Desk.
- Continue to investigate control and operator sensing strategies and configurations for teleoperated manipulator devices performing military tasks.
- Initiate development of operator workload models for unmanned ground vehicles.

Project AH70

Page 5 of 7 Pages

Exhibit R-2 (PE 0602716A)

202

Item 18

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
AH70

## 2 - Applied Research

0602716A Human Factors Engineering  
Technology

## FY 1998 Planned Program: (continued)

- Publish findings on sensor human feedback devices and exoskeleton control devices.
- Continue to verify and validate the auditory detection model. Conduct a study to assess the impact of multi-directional auditory displays on crew performance in armored vehicles.
- Continue to conduct simulations in a distributed interactive simulation (DIS) environment for decision making by a dispersed force.
- Continue to develop unique features and refinements to the human figure performance model (JACK) with emphasis on improving run-time, user interface and fidelity and decreasing the time and cost to use critical features.
- Complete Improved Performance Research Integration Tool (IMPRINT), version 3, which incorporates embedded analysis wizard, advanced workload analysis capability, and updated resident databases.
- Refine the virtual reality capability for the individual soldier fighting systems in a DIS environment; integrate the sensor suit (which records the movements of humans engaged in strenuous exercise) and a low to medium resolution version of the soldier icon (JACK); initiate collection of baseline data for live and virtual studies.
- Continue to develop soldier-system analysis and tradeoff tools for assessing soldier and unit performance and the life cycle cost implications of choices in concept and system designs.
- Provide HFE support to AMC, AMC RDECs, TRADOC activities, battle labs, and other laboratories.
- Develop an integrated set of soldier-information system performance based design standards and demonstrate in Division 98.

Total 14256

## FY 1999 Planned Program:

- 5761 -Demonstrate integrated logistic planning tools in advanced warfighting experiments and related Force XXI activities.
- Continue development of operator workload models for unmanned ground vehicles; conduct user operational investigations in countermine operations, and reconnaissance, surveillance and target acquisition operations; incorporate results into the operator workload model.
- Expand the study investigating the impact of multi-directional auditory displays to helicopter pilot performance and dismounted soldier performance.
- Develop a human performance measurement strategy to assess new command and control concepts in the distributed interactive simulation (DIS) environment.
- Develop performance-based specifications for prioritizing the Army's investment in advanced 2-D and 3-D visualization concepts across the battle staff's task domain, and in new media technologies that support collaborative planning and problem solving by a geographically dispersed staff.
- Initiate development of a cognitive task analysis model to examine the impact of new media technologies on battlefield command and control.
- 4667 -Verify and validate the human figure performance model (JACK), link with physics based model, and begin to incorporate data collected in 3-D.
- Add training requirements analysis capability and enhanced performance degradation modeling to Improved Performance Research Integration Tool (IMPRINT) Version 3.

Project AH70

Page 6 of 7 Pages

Exhibit R-2 (PE 0602716A)

203

Item 18

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

2 - Applied Research

PE NUMBER AND TITLE

0602716A Human Factors Engineering  
Technology

PROJECT

AH70

## FY 1999 Planned Program: (continued)

- Collect performance data using the virtual reality capability for the individual soldier fighting systems in a DIS environment, compare results of live and virtual studies, and update and validate the databases with actual research data.
- 5198 -Initiate development of an integrated soldier-system analysis and design tool supporting materiel design, doctrine writing and training architecture development. Continue enhanced human factors engineering field evaluation methods with soldier in the loop operational test data to upgrade existing capabilities to assess new technologies and systems.
- Provide HFE support to AMC, AMC RDECs, TRADOC activities, battle labs, and other laboratories.

Total 15626

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
12195	14072	15080	14877
12534	13765		
-408			
12126	13765	14256	15626

Project AH70

Page 7 of 7 Pages

Exhibit R-2 (PE 0602716A)

204

Item 18

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602720A Environmental Quality Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25537	55178	17519	13869	13782	14747	15062	15617	Continuing	Continuing
D048 Industrial Operations Pollution Control Technology	1407	5945	2439	2501	2593	2722	2803	2889	Continuing	Continuing
A822 Facility Environmental Management and Monitoring System (FEMMS)	0	1958	0	0	0	0	0	0	0	1958
A823 Hawaii Small Business Development Center	5121	5287	0	0	0	0	0	0	0	10408
A826 Unexploded Ordnance Remediation	0	3916	0	0	0	0	0	0	0	3916
A829 National Defense Center for Environmental Excellence (NDC EE) Technology	12516	12895	5269	0	0	0	0	0	0	30680
A835 Military Medical Environmental Criteria	2340	3103	3418	3308	3276	3744	3823	4014	Continuing	Continuing
A876 Plasma Energy Pyrolysis System	0	7343	0	0	0	0	0	0	0	7343
A877 Western Environmental Technology Office Environmental Support	0	4895	0	0	0	0	0	0	0	4895
A896 Base Facility Environmental Quality	2436	7257	3067	4553	4336	4566	4610	4762	Continuing	Continuing
AF25 Military Environmental Restoration Technology	1717	2579	3326	3507	3577	3715	3826	3952	Continuing	Continuing

**Mission Description and Budget Item Justification:** This Program Element (PE) provides technology that allows the Army to comply with regulations mandated by all Federal, State and local environmental/health laws and to reduce the cost of this compliance. Examples of key laws include the Superfund Amendments and Reauthorization Act of 1986 and the Defense Environmental Restoration Act (the DoD equivalent of this law), in addition to the Resource Conservation and Recovery Act of 1984, as amended. This PE provides the Army with a capability to decontaminate or neutralize Army-unique hazardous and toxic wastes at sites containing waste ammunition, explosives, heavy metals, propellants, smokes, chemical munitions, and other organic contaminants. The current DoD estimate for the total Army cost of completing this

Page 1 of 19 Pages

Exhibit R-2 (PE 0602720A)

205

Item 19

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE <b>0602720A Environmental Quality Technology</b>	
<p>cleanup program is eight to ten billion dollars. This PE also provides technology to avoid the potential for future hazardous waste problems, by reducing hazardous waste generation through process modification and control, materials recycling and substitution. This PE develops pollution control technology which assists installations to comply with environmental regulations at less cost. The PE also provides technology to mitigate noise impacts and maneuver area damage resulting from Army training activities. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on civil engineering and environmental quality with oversight provided by the Joint Engineers and Armed Services Biomedical Research Evaluation and Management. These projects include non-system specific development efforts directed at specific military needs and are appropriate to Budget Activity 2.</p>		

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		DATE								February 1997	
2 - Applied Research		PE NUMBER AND TITLE								PROJECT	
		0602720A Environmental Quality Technology								D048	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D048 Industrial Operations Pollution Control Technology		1407	5945	2439	2501	2593	2722	2803	2889	Continuing	Continuing

**A. Mission Description and Justification:** This project provides pollution control technologies required to reduce the cost of treating hazardous toxic effluent from the operation of Army industrial installations, which include ammunition plants, depots and arsenals, and to satisfy increasingly stringent wastewater discharge standards under the Clean Water Act and relevant state regulations. Federal facilities are now subject to fines and facility shutdowns for violation of federal, state, and local air and wastewater discharge regulations. This new technology is essential to control and reduce generation of hazardous waste, to satisfy hazardous waste reduction goals and to avoid future hazardous waste disposal costs and liabilities to the Army. This project will provide compliance tools to control toxic air pollutants regulated under the Clean Air Act amendments. Efforts will focus on new energetic materials which will enter the Army inventory within the next decade to assure that ammunition plants will remain compliant. Changes in solid, liquid, and gaseous emissions resulting from pollution prevention efforts will require technology changes to existing treatment systems to compensate. The primary developing agency is the US Army Construction Engineering Research Laboratories, Champaign, IL.

**FY 1996 Accomplishments:**

- 807 - Developed transition plans for nitrocellulose treatment technology.
  - Developed guidance on reduced smoke propellants as a fuel source.
  - Developed guidance on air toxins from plating operations.
  - 600 - Initiated development of technology for reuse of waste ammonium nitrate.
  - Developed volatile organic compound (VOC) treatment technology for industrial operations.
- Total 1407

**FY 1997 Planned Program:**

- 1972 - Develop preliminary guidance on pyrolytic behavior of energetic materials.
  - Develop guidelines for treatment and use of munitions wastes.
  - Develop biofilter technology for treatment of VOCs from industrial operations.
  - 3873 - Congressionally directed effort to demonstrate a wastewater treatment testbed at the Bremerton Naval Shipyard (to be executed by Navy).
  - 100 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 5945

Project D048

Page 3 of 19 Pages

Exhibit R-2 (PE 0602720A)

207

Item 19

UNCLASSIFIED



## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602720A Environmental Quality Technology</b>	<b>D048</b>	
<b>FY 1998 Planned Program:</b>			
•	2439 - Initiate development of adaptive tuning control algorithms for industrial wastewater treatment plant automation.		
	- Develop biofilter technology for treatment of VOCs from industrial operations.		
	- Develop improved biological treatment technologies for energetic wastewater employing sulfate reduction environments.		
	- Develop engineered gelatin technology for stabilization of industrial waste streams contaminated with heavy metals.		
Total	2439		
<b>FY 1999 Planned Program:</b>			
•	2501 - Develop technology for electrochemical reduction of energetic compounds in water.		
	- Develop technology and guidelines for minimizing hazardous air pollutant emissions from industrial operations supporting Army installations.		
	- Initiate development of technology and guidelines for using focused high energy acoustic beams to destroy energetic contaminated industrial wastes.		
	- Develop thermal plasma techniques for the pyrolytic destruction of organic energetic wastes and the vitrification of heavy metal-bearing wastes.		
Total	2501		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget		FY 1997	FY 1999
Appropriated Value	1498	2072	2426
Adjustments to Appropriated Value	1539	5945	2485
FY 1998 Pres Bud Request	-130		
	1407	5945	2439
			2501
Change Summary Explanation: Funding: FY1997 - Congressionally-directed effort to demonstrate a wastewater treatment testbed at the Bremerton Naval Shipyard (+3873).			

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0602720A Environmental Quality Technology PROJECT A822

## 2 - Applied Research

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A822 Facility Environmental Management and Monitoring System (FEMMS)	0	1958	0	0	0	0	0	0	0	1958

**A. Mission Description and Justification:** - This Congressionally-mandated pollution prevention project is managed by the Army to further develop and implement a testbed demonstrator at Tobyhanna Army Depot (TYAD) for automated control and real-time monitoring management of environmental emissions, pollutants, and wastes. Phase I was completed in FY 95 with the identification and analysis of TYAD facility environmental management needs, the conceptualization of the FEMMS, prototype module designs, and implementation of FEMMS in coordination with the National Defense Center for Environmental Excellence (NDCEE). Phase II was completed in 1st quarter FY 96 with the selection of baseline FEMMS module designs.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 1910 - Expand consideration of pollutants and wastes at TYAD being monitored by FEMMS.
- - Develop additional FEMMS modules; complete project.
- 48 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 1958

**FY 1998 Planned Program:** Effort completed with FY 1997 funding.

**FY 1999 Planned Program:** Effort completed with FY 1997 funding.

**B. Project Change Summary**

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	0	0	0	0
Adjustments to Appropriated Value		1958		
FY 1998 Pres Bud Request	0	1958	0	0

Change Summary Explanation: Funding: FY 1997 - Congressional plus-up (+1958) for additional development of FEMMS.

Project A822

Page 5 of 19 Pages

Exhibit R-2 (PE 0602720A)

209

Item 19

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																																								
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																																									
2 - Applied Research		0602720A Environmental Quality Technology								A823																																									
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																																								
A823	Hawaii Small Business Development Center	5121	5287	0	0	0	0	0	0	0	10408																																								
<p><b>A. Mission Description and Justification:</b> This Congressionally-mandated project is a continuation of an effort begun and funded in FY 93 under project A830. The project has technology policy goals favoring activities that meet dual-use and employment-creating criteria. The former refers to commercializing products that are used by Armed Services personnel as well as the civilian population. The latter is offered as a contribution to US economic revitalization. The approach being followed involves private-public partnerships to carry out activities leading to the commercialization of these products. These include but are not limited to pharmaceuticals, industrial products, and food products derived from the agricultural resources of transitioning sugar plantations in Hawaii. Advisory personnel from federal agencies (primarily the Departments of Defense and Agriculture) and state agencies participate at the work group and oversight committee levels.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>5121 - Continued development of agricultural-industrial products having potential for dual-use and commercialization, focusing on native Hawaiian agricultural crops with potential application for medicine/food/biofuel use in the military.</li> </ul> <p>Total 5121</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5158 - Continue development of agricultural-industrial products having potential for dual-use and commercialization, focusing on native Hawaiian agricultural crops with potential application for medicine/food/bioremediation use in the military.</li> <li>129 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 5287</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>5253</td> <td>FY 1996</td> <td>0</td> <td>FY 1997</td> <td>0</td> <td>FY 1998</td> <td>0</td> <td>FY 1999</td> <td>0</td> </tr> <tr> <td>Appropriated Value</td> <td>5400</td> <td></td> <td>5287</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-279</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>5121</td> <td></td> <td>5287</td> <td></td> <td></td> <td></td> <td>0</td> <td></td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY1997 - Congressional plus-up (+5287) for additional development of agricultural-industrial products.</p>												FY 1997 President's Budget	5253	FY 1996	0	FY 1997	0	FY 1998	0	FY 1999	0	Appropriated Value	5400		5287							Adjustments to Appropriated Value	-279									FY 1998 Pres Bud Request	5121		5287				0		0
FY 1997 President's Budget	5253	FY 1996	0	FY 1997	0	FY 1998	0	FY 1999	0																																										
Appropriated Value	5400		5287																																																
Adjustments to Appropriated Value	-279																																																		
FY 1998 Pres Bud Request	5121		5287				0		0																																										

Project A823

Page 6 of 19 Pages

Exhibit R-2 (PE 0602720A)

210

Item 19

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

## BUDGET ACTIVITY

## PE NUMBER AND TITLE

0602720A Environmental Quality Technology

PROJECT  
A826

## 2 - Applied Research

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A826 Unexploded Ordnance Remediation	0	3916	0	0	0	0	0	0	0	3916

**A. Mission Description and Justification:** This project is of Congressional special interest. The purpose of the project is to conduct a demonstration of technology to detect and remediate unexploded ordnance (UXO) using the Jefferson Proving Ground (JPG) as the test site. The primary thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater, and structures and to ensure that human health and the environment are protected. Research will be conducted in detection, discrimination, identification, characterization, and monitoring of UXO. Emphasis will be placed on the development of near real-time sensing and insitu remediation.

**FY 1996 Accomplishments:** Project not funded in FY 96

**FY 1997 Planned Program:**

- 3821 - Develop geophysical methods for the identification and discrimination of UXO.
- Develop methods for geophysical background feature site characterization related to UXO identification and discrimination.
- Refine sensor/data fusion and analysis techniques to reduce nuisance and false alarms.
- 95 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 3916

**FY 1998 Planned Program:** Project not funded in FY 98

**FY 1999 Planned Program:** Project not funded in FY 99

**B. Project Change Summary**

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	0	0	0	0
Adjustments to Appropriated Value		3916		
FY 1998 Pres Bud Request	0	3916	0	0

Change Summary Explanation: Funding: FY 1997 - Congressional plus-up (+3916) for UXO applied research.

Project A826

Page 7 of 19 Pages

Exhibit R-2 (PE 0602720A)

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602720A Environmental Quality Technology

A829

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A829 National Defense Center for Environmental Excellence (NDCEE) Technology	12516	12895	5269	0	0	0	0	0	0	30680

**A. Mission Description and Justification:** The mission of the National Defense Center for Environmental Excellence (NDCEE) is to demonstrate and export new environmentally acceptable technology to the industrial base on the use of the new technology, perform research and development, where necessary, to mature a new technology prior to demonstrating and export the technology to the industrial base. The NDCEE evaluates and validates alternative manufacturing materials, treatments and processes which comply with environmental and occupational health regulations. NDCEE is transitioning to self-sufficiency by FY 1999. The primary in-house development agency is the US Army Materiel Command's Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ.

## FY 1996 Accomplishments:

- 12516 - Maintained/upgraded environmental technology facility (flashjet, spongejet, carbon dioxide turbine wheel stripper, water recycle units, ion beam implanter, supercritical painting system); performed industrial base integration and environmental analyses.
- Continued execution of Congressionally-directed efforts: plastic sortation, industrial health risk assessments, NitRem removal process demonstration, and Adams process investigation.
- Demonstrated technology transfer and transition of: non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping, paint handling and spraying equipment, ion beam processing, material and process substitution program, and supercritical carbon dioxide (liquid) as a replacement for solvents in paint.

Total

12516

## FY 1997 Planned Program:

- 7857 - Maintain/upgrade environmental technology facility (supercritical cleaning system, automatic plating, thermoplastic coatings, wet/dry blast booth, high velocity oxygen fuel spray, central water polishing unit); perform industrial base integration and environmental analyses.
- Continue execution of Congressionally-directed efforts: industrial health risk assessments and NitRem removal process demonstration.
- Demonstrate and transition: non-halogenated metal parts cleaning, electrodeposited coatings, powder coating demonstration, non-chrome conversion coatings, waterjet paint stripping, paint handling and spraying equipment, flashjet stripping, ion beam processing, material and process substitution program, cadmium plating alternatives, and supercritical carbon dioxide as a replacement for solvents in paint.
- 4725 - Demonstrate and transition: new materials to help sustain the manufacturing base by exploiting waste products as a resource; simulations to speed the implementation process of new technologies into manufacturing processes; techniques to help designers decide on materials and processes for environmentally safe manufacturing; and techniques for teardown, disassembly, and reuse to eliminate open burning and open detonation as a means of disposal.

Project A829

Page 8 of 19 Pages

Exhibit R-2 (PE 0602720A)

212

Item 19

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
<b>2 - Applied Research</b>	<b>0602720A Environmental Quality Technology</b>	<b>February 1997</b>	<b>A829</b>																									
<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>• 313 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 12895</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 5269 - Maintain environmental technology facility (pretreatment line, power washers, flashjet, honeycomb cleaner, carbon dioxide turbine wheel stripper, mobile treatment units, ion beam implanter, supercritical painting system, advanced immersion system, media booths, alternative plating line); perform industrial base integration and environmental analyses.</li> <li>- Continue to execute Congressionally-directed efforts: industrial health risk assessments and NitRem removal process demonstration.</li> <li>- Demonstrate and transition: non-chrome conversion coatings, waterjet paint stripping, paint handling and spraying equipment, ion beam processing, cadmium replacements, and supercritical carbon dioxide as a replacement for solvents in paint.</li> </ul> <p>Total 5269</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99. Program is to become self-sufficient in FY 1999.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>12836</td> <td>8170</td> <td>5273</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>13196</td> <td>12895</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-680</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>12516</td> <td>12895</td> <td>5269</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997 - Congressional plus-up (+4725).</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	12836	8170	5273	0	Adjustments to Appropriated Value	13196	12895			FY 1998 Pres Bud Request	-680					12516	12895	5269	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	12836	8170	5273	0																								
Adjustments to Appropriated Value	13196	12895																										
FY 1998 Pres Bud Request	-680																											
	12516	12895	5269	0																								

Project A829

Page 9 of 19 Pages

Exhibit R-2 (PE 0602720A)

213

Item 19

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY		PE NUMBER AND TITLE										PROJECT	
2 - Applied Research		0602720A Environmental Quality Technology										A835	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost		
A835	Military Medical Environmental Criteria	2340	3103	3418	3308	3276	3744	3823	4014	Continuing	Continuing		

**A. Mission Description and Justification:** This project evaluates human health and environmental effects resulting from exposure to explosives, propellants, and smokes produced in Army industrial and field operations or disposed of through past activities. The end results of this research are determinations of acceptable residual concentration levels that will protect human health and the environment from adverse effects. The products of this research are US Environmental Protection Agency approved health advisories and criteria documents to be used in risk assessment procedures. These criteria are used by the Army during negotiations with regulatory officials to set scientifically and economically rational safe cleanup and discharge levels at Army installations. The primary developing laboratories are the US Army Biomedical Research and Development Laboratory (USABRDL), Ft. Detrick, MD, the Center for Health Promotion and Preventive Medicine (CHPPM), Edgewood, MD, and the Waterways Experiment Station (WES), Vicksburg, MS.

**FY 1996 Accomplishments:**

- 929 - Continued development of munitions biomarkers and bioeffects (CHPPM).
- Performed toxicological evaluation of munitions and degradation products (CHPPM).
- Continued development of toxicity predictions using structure activity relationships and produced health advisories and criteria for military unique chemicals (CHPPM).
- 1411 - Continued development of cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM).
- Continued development of fate and transport of military-unique compounds and developed microbial biomarkers (WES).
- Continued identifying biomarkers to monitor bioattenuation of military-unique compounds and develop exposure models (WES).
- Continued applying sentinel biomonitoring systems and applying methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).

Total 2340

**FY 1997 Planned Program:**

- 2015 - Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM).
- Produce health advisories and criteria for military-unique chemicals and develop toxicity predictions using structure activity relationships (CHPPM).
- Develop cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
- 1012 - Develop fate and transport of military-unique compounds and microbial biomarkers (WES).
- Identify biomarkers to monitor bioattenuation of military-unique compounds (WES).
- Develop exposure models and decision-making framework for ecological risk assessment (WES).

Project A835

Page 10 of 19 Pages

Exhibit R-2 (PE 0602720A)

214

Item 19

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		DATE	PROJECT
2 - Applied Research		February 1997	A835
PE NUMBER AND TITLE		0602720A Environmental Quality Technology	

## FY 1997 Planned Program: (continued)

- 76 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3103

## FY 1998 Planned Program:

- 3418 - Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM).
- Produce health advisories and criteria for military-unique chemicals and develop toxicity predictions using structure activity relationships (CHPPM).
- Develop cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
- Develop fate and transport of military-unique compounds and microbial biomarkers (WES).
- Identify biomarkers to monitor bioattenuation and effects of military-unique compounds (WES).
- Develop exposure and effects models and decision-making framework for ecological risk assessment (WES).

Total 3418

## FY 1999 Planned Program:

- 3308 - Develop munitions biomarkers and bioeffects and conduct toxicological evaluation of munitions and degradation products (CHPPM).
- Produce health advisories and criteria for military-unique chemicals and develop toxicity predictions using structure activity relationships (CHPPM).
- Develop cross-species extrapolation of non-mammalian bioassays (USABRDL/CHPPM), apply sentinel biomonitoring systems (USABRDL), and apply methods for integrated environmental assessment of contaminated sites at Army installations (USABRDL).
- Develop fate and transport of military-unique compounds and microbial biomarkers (WES).
- Identify biomarkers to monitor bioattenuation and effects of military-unique compounds (WES).
- Develop exposure and effects models and decision-making framework for ecological risk assessment (WES).

Total 3308

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2179	3169	3416	3304
2240	3103		
+100			
2340	3103	3418	3308

Project A835

Page 11 of 19 Pages

Exhibit R-2 (PE 0602720A)

215

Item 19

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602720A Environmental Quality Technology								A876	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A876	Plasma Energy Pyrolysis System	0	7343	0	0	0	0	0	0	0	7343
<p><b>A. Mission Description and Budget Item Justification:</b> This project provides a compliance and pollution control technology required to reduce the cost of treatment and disposal of hazardous and toxic site waste streams resulting from production or deactivation of military items or components. Plasma arc technology application enables the military to reduce the need for landfills and their future liability-related issues in a one step, safe, and economic process. The project will deliver an effective compliance technology to control and dispose of recalcitrant hazardous and toxic wastes regulated under Resource Conservation and Recovery Act amendments, in addition to satisfying the increasingly stringent emission standards of the Clean Air Act relevant to open burning/open detonation practices within the military. A plasma arc processing unit can reduce the significant costs associated with the many steps involved in other conventional hazardous waste treatment technologies, such as: sample characterization lead time, health and safety exposure risks to workers, and increased risks to the general public from accidents involving the excavated and transported wastes. The development and field demonstration of plasma arc technology will provide the user community with a much-needed tool for military hazardous waste processing and disposal on a flexible basis. In particular, developing a mobile unit's specifications, design, and blueprints will enable the Army, working with the Air Force, to converge on a mobile unit configuration and cut the time for field implementation.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 7164 - Develop plans and permits for field demonstrations.</li> <li>- Develop and characterize waste matrix guidelines.</li> <li>- Design and procure mobile unit for field applications.</li> <li>- Field demonstration.</li> <li>• 179 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> <li>Total 7343</li> </ul> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p>											

Project A876

Page 12 of 19 Pages

Exhibit R-2 (PE 0602720A)

216

Item 19

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602720A Environmental Quality Technology

A876

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

0

FY 1997

0  
7343

FY 1998

0

FY 1999

0

Change Summary Explanation: Funding: FY1997 - Congressional plus-up (+7343) to develop plasma arc technology.

Project A876

Page 13 of 19 Pages

Exhibit R-2 (PE 0602720A)

217

Item 19

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE  
February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602720A Environmental Quality Technology

A877

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A877 Western Environmental Technology Office Environmental Support	0	4895	0	0	0	0	0	0	0	4895

**A. Mission Description and Justification:** This Congressionally-directed effort with the Western Environmental Technology Office (WETO) provides for the transfer of environmental compliance technologies required to reduce the cost for treating hazardous and toxic pollutants from Army industrial operations which include Army ammunition plants, depots, and arsenals, and to help satisfy increasingly stringent environmental regulations on DoD and the Department of Energy (DOE). Those environmental requirements include wastewater discharge standards under the Clean Water Act and relevant State regulations, hazardous air pollutant emission standards under the Clean Air Act Amendments (CAAA), requirements under Federal Facilities Compliance Act and Resource Conservation and Recovery Act and other regulations. The US Army Construction Engineering Research Laboratories (CERL) works closely with the Industrial Operations Command (IOC) to transfer environmental compliance and pollution prevention technologies to IOC installations. This project will support the transfer of environmental technologies to IOC installations. This enables the Army to reduce environmental compliance costs and future environmental liability costs. The technology transfer projects under this project should result in model industrial operations with environmental compliance which will help accelerate technology transfer to similar industrial operations within DoD. The primary technology transfer agency is the US Army Construction Engineering Research Laboratories, Champaign, IL. WETO is a privatized former component of DOE (as of September 1996). WETO will evaluate and demonstrate technologies to help DOE meet a requirement to clean up its sites.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 4775 - Engineering design and evaluation of technologies to remove and detoxify metals and energetics in wastewater.
- Design and construction of hazardous air pollutant control technology.
- Construction and evaluation of technologies to treat oily waste and solvents.
- 120 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 4895

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99.

Project A877

Page 14 of 19 Pages

Exhibit R-2 (PE 0602720A)

218

Item 19

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602720A Environmental Quality Technology	A877	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	0	0	0
Adjustments to Appropriated Value		4895	
FY 1998 Pres Bud Request	0	4895	0
Change Summary Explanation: Funding: FY1997 - Congressional plus-up (+4895) .			

Project A877

Page 15 of 19 Pages

Exhibit R-2 (PE 0602720A)

219

Item 19

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE							DATE	PROJECT
2 - Applied Research		0602720A Environmental Quality Technology							February 1997	A896
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A896 Base Facility Environmental Quality	2436	7257	3067	4553	4336	4566	4610	4762	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides the Army with the technical capability to protect and improve the biological and physical characteristics of fixed installation training and testing areas needed to sustain readiness while also conserving protected natural and cultural resources, including threatened and endangered species. Technology developed within this project will enable training and testing land users to match usage events and schedules to the capabilities of specific land areas, and will also provide advanced methods to restore lands damaged in readiness exercises. Efforts under this project will also enable the Army to prevent pollution in facilities base operations, and to comply with the myriad Federal, state and host country environmental regulations dealing with hazardous and non-hazardous water, wastewater, air emission, solid waste (including sediment discharge) and noise. An additional effort is the development of environmental monitoring and modeling capabilities to support environmentally sustainable installation lands and facilities. The primary developing agency is the US Army Construction Engineering Research Laboratories, Champaign, IL.</p>										
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2436 - Developed automated system for selecting revegetation plant species in different ecological regions.</li> <li>- Developed threatened and endangered species (TES) inventory and monitoring protocols.</li> <li>- Developed guidelines for mitigating environmental impacts of lead-based paint removal.</li> <li>- Developed simulation for predicting small arms range noise.</li> </ul> <p>Total 2436</p>										
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3344 - Develop Phase I plant succession model for training land carrying capacity.</li> <li>- Develop TES Army wide status reporting system.</li> <li>• 3845 - Develop a Congressionally-mandated agriculture-based bioremediation capability (to be executed by Army Environmental Center).</li> <li>- Initiate development of pollution prevention procedures for solvents, cleaners, and oil-water separation.</li> <li>• 68 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 7257</p>										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3067 - Develop cause/effect relationships between training activities and impacts on threatened and endangered species.</li> <li>- Complete addition of weather statistics and terrain effects on improved noise propagation models.</li> <li>- Identify and characterize the mechanisms that cause volatile organic carbon emissions from solvent and petroleum product usage.</li> </ul> <p>Total 3067</p>										
Project A896										

Exhibit R-2 (PE 0602720A)

Page 16 of 19 Pages

220

Item 19

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602720A Environmental Quality Technology

A896

## FY 1999 Planned Program:

- 4553 - Develop validated risk assessment models to determine the effects of Army activities on habitat disturbance.
- Provide knowledge, approach, and tools to match training land use and land capacity in selected ecoregions.
- Develop decision support methodologies for assessment and mitigation of maneuver training impacts on threatened and endangered species.
- Complete guidance for identifying pollution prevention alternatives for Army applications.

Total 4553

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

2425

2491

-55

2436

FY 1997

3412

7257

FY 1998

4053

FY 1999

5539

4553

Change Summary Explanation: Funding: FY1997 - Congressional plus-up (+3845) to develop a Congressionally-mandated agriculture based bioremediation capability.

FY1998 - Funds reprogrammed (-986) to higher priority requirements.

FY1999 - Funds reprogrammed (-986) to higher priority requirements.

Project A896

Page 17 of 19 Pages

Exhibit R-2 (PE 0602720A)

221

Item 19

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602720A Environmental Quality Technology								AF25	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AF25	Military Environmental Restoration Technology	1717	2579	3326	3507	3577	3715	3826	3952	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides cost effective technologies required to clean up DoD hazardous waste sites, including active installations under the Installation Restoration Program, those indicated for closure under the DoD Base Realignment and Closure Program and the Formerly Used Defense Sites Program. The primary thrust of this effort is to expedite site cleanup, reduce the cost of cleanup of contaminated soil, groundwater and structures, and to ensure that human health and the environment are protected. Research is conducted in several major areas: innovative and cost-effective site identification, characterization, and monitoring technologies; groundwater systems; treatment technologies to remediate soil and groundwater contaminated with military-unique contaminants such as explosives/energetics, chemical agents, heavy metals, and other organics. Emphasis is placed on the development of in-situ remediation technologies and real or near real-time sensing technologies. Development of existing technologies provides near-term solutions, while adding to the knowledge base applicable to successful development of more complex in-situ technologies. The primary developing agency is the US Army Engineer Waterways Experiment Station, Vicksburg, MS.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1441 - Provided improved analytical methods for hydrazine and field analysis techniques for nitrocellulose.</li> <li>• 276 - Began development of design criteria and assessment of in-situ and ex-situ physical processes for remediation of explosives/organics-contaminated soils.</li> <li>• 276 - Developed methods of assessing extraction techniques for metals-contaminated soils.</li> <li>• 276 - Developed remediation technology modules for Groundwater Modeling Systems.</li> <li>• 1717 - Conducted field demonstration of Site Characterization and Analysis Penetrometer System (SCAPS) analytical/sampler interface.</li> </ul> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2522 - Develop improved laboratory analytical methods for identifying organic contaminants in soils.</li> <li>• 2522 - Demonstrate thermal desorption sampler for volatile organic compounds and solvent detection.</li> <li>• 2522 - Complete design criteria and assessment of in-situ and ex-situ chemical processes for remediation of explosives/organics-contaminated soils.</li> <li>• 2522 - Demonstrate physical separation technology for remediation of heavy metals-contaminated soils and test methods to predict mobility of metals.</li> <li>• 57 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p><b>Total</b> 2579</p>											

Project AF25

Page 18 of 19 Pages

Exhibit R-2 (PE 0602720A)

222

Item 19

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602720A Environmental Quality Technology

PROJECT

AF25

## FY 1998 Planned Program:

- 3326 - Develop advanced soil sampler system as part of the SCAPS.
- Develop Groundwater Modeling System (GMS) Version 2, housing a remedial module with fate/transport packages for explosives and metals.
- Develop improved chemical analytical techniques for detecting and quantifying special organic compounds in complex media.
- Provide technical data package of advanced concepts for in-situ biological treatment of explosives-contaminated media.
- Develop chemical extraction technologies for heavy metals-contaminated soils.

Total 3326

## FY 1999 Planned Program:

- 3507 - Develop an enhanced instrumentation package for the SCAPS and continue development of on-site data visualization and analysis.
- Incorporate in-situ bioremediation and electrokinetics design modules into the GMS version 2 model.
- Continue development of advanced biological ex-situ (bioreactors) and in-situ treatment of contaminated soils and physical/chemical methods for groundwater.

Total 3507

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	1786	2634	3323	5009
Adjustments to Appropriated Value	1838	2579		
FY 1998 Pres Bud Request	-121			
	1717	2579	3326	3507

Change Summary Explanation: Funding: FY 1999 - Funds reprogrammed (-1502) to higher priority requirements.

Project AF25

Page 19 of 19 Pages

Exhibit R-2 (PE 0602720A)

223

Item 19

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE									
2 - Applied Research		0602782A Command, Control, Communications Technology									
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		13130	14976	16838	18180	18120	18775	19174	19588	Continuing	Continuing
AH92 Communications Technology		8526	7863	9254	9925	9893	10251	10469	10696	Continuing	Continuing
A779 Command/Control (C2) and Platform Electronics Technology		4604	7113	7584	8255	8227	8524	8705	8892	Continuing	Continuing

**Mission Description and Budget Item Justification:** Faced with an increasing responsibility for meeting contingencies worldwide, field commanders must be capable at short notice of providing battlefield communications to and from virtually any place on earth. The communications technology project (AH92) explores the development of those advanced communications technologies required to provide a worldwide communications capability. The objective of the command/control (C2) and platform electronics technology project (A779) is to expand scientific knowledge for demonstration of state-of-the-art technologies, including command/control and electronic systems/subsystems, performance reliability, maintainability, safety, survivability, and man-machine interface for all Army air and ground platforms, including soldier systems and equipment. Development of an infrastructure that will allow timely distribution, display and use of C2 data on Army platforms will lead to greater battlefield functional capabilities, survivability and total integration into the digitized battlefield. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0603006A (Command, Control and Communications Advanced Technology), PE 0602783A (Computer and Software Technology) and PE 0603734A (Military Engineering Advanced Technology). It includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. Work in this program element is performed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Fort Monmouth, NJ.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

2 - Applied Research

PE NUMBER AND TITLE

0602782A Command, Control, Communications

Technology

PROJECT

AH92

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH92 Communications Technology	8526	7863	9254	9925	9893	10251	10469	10696	Continuing	Continuing

**A. Mission Description and Justification:** The exploratory development efforts in this project focus on developing and leveraging/adapting commercial communications technologies required to meet the information needs of the Force XXI battlefield. Several of the efforts also provide supporting technology for the Digital Battlefield Communications Advanced Technology Demonstration (ATD), the Battlefield Information Transmission (BITS) strategy and several other ATDs. Key technologies being addressed include: the adaptation and implementation of asynchronous transfer mode (ATM) switching technology in a hostile mobile environment, the adaptation and interface with commercial Personal Communications Technology, development of realistic models for emerging communications systems in dynamic field environments, the development and application of several tactical antenna technologies, the development of photonic controls for phased array antennas, and the development of solutions to address problems associated with implementation of Mobile internet protocol (IP) spread across different IP nets. These efforts also directly support the Information Systems and Technology Defense Technology Objectives outlined in the Defense Technology Area Plan and the Advanced Battlespace Information Systems study.

**FY 1996 Accomplishments:**

- 4399 - Continued development of a broadcast ATM capability and monitoring and control function for mobile networks. Developed hierarchical video routing gateway to translate signaling between ATM and IP networks.
- Developed prototype UHF conformal structurally embedded reconfigurable antenna technology (SERAT) antenna for aircraft application. Continued experimental development of structure tuned antenna switches.
- Demonstrated prototype 16-element photonic integrated phase and amplitude controller (IPAC) for phased array antenna control. Initiated development of optical phase locked loop transmitter for optically controlled phased array antennas.
- 4127 - Demonstrated validity of improved spectrum efficiency modeling as it supports wide band data radios and high capacity trunk radio systems design and planning.
- Developed and demonstrated prototype personal communications system (PCS) wireless private branch exchange (PBX) for support of digital battlefield communications ATD.
- Developed range extension test bed and a tracking and reporting system (TRS).
- Experimented with integration of a surrogate digital radio (SDR) in an aircraft platform and demonstrated color video routing.

Total 8526

**FY 1997 Planned Program:**

- 3848 - Complete development of optical phase locked loop (OPLL) transmitter for optically controlled phased array antennas. Demonstrate OPLL module and IPAC in 16-element Optically Controlled Phased Array Antenna.

Project AH92

Page 2 of 6 Pages

Exhibit R-2 (PE 0602782A)

225

Item 20

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<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		
BUDGET ACTIVITY	PE NUMBER AND TITLE	DATE
<b>2 - Applied Research</b>	<b>0602782A Command, Control, Communications</b>	<b>February 1997</b>
	<b>Technology</b>	PROJECT <b>AH92</b>
<b>FY 1997 Planned Program: (continued)</b>		
	<ul style="list-style-type: none"> <li>- Develop software for modeling communication systems for high capacity transmission on-the-move in a battlefield environment.</li> <li>- Demonstrate advanced wireless PBX technology.</li> <li>- Initiate development of a next generation PCS capability for the dismounted soldier by adapting commercial cellular code division multiple access (CDMA) and wide CDMA (W-CDMA) technology.</li> <li>- Demonstrate hierarchical video routing between ATM and IP multicast networks, and integrate broadcast protocol with the radio access point.</li> <li>- Continue SERAT conformal antenna development/evaluation for helicopter application. Demonstrate optically activated antenna switch.</li> <li>- Continue development of range extension and testing in conjunction with digital battlefield communications radio access point and high capacity trunk radio programs.</li> <li>- Initiate technology development in support of C2 protect for information operations (IO), focusing on protection and detection of network attacks to the tactical internet.</li> </ul>	
<b>Total</b>	<b>7863</b>	
<b>FY 1998 Planned Program:</b>		
	<ul style="list-style-type: none"> <li>- Develop solutions to address problems of mobile IP hosts spread across different IP nets in hostile environments. Analyze mobile ATM and resource allocation in mixed (ATM/IP/narrow integrated services digital network (N-ISDN)) networks.</li> <li>- Integrate and evaluate/demonstrate a SERAT conformal antenna in a UH-60 configuration. Demonstrate a broadband antenna technology (2MHz-2GHz) for SpeakEasy applications. Initiate super high frequency (SHF) on the move (OTM) antenna positioner/tracker development and develop element topology for structure tuned VHF antenna.</li> <li>- Initiate development of the final integrated photonic control system for single/multi panel phased arrays.</li> <li>- Initiate efforts to expand the system performance models to include the emerging communications technologies and systems.</li> <li>- Implement data protocols in support of next generation soldier PCS.</li> <li>- Integrate, evaluate, and demonstrate an end-to-end SHF surrogate satellite system concept. Initiate development of an on-board switching capability for the high capacity relay.</li> <li>- Continue technology development for C2 Protect for Information operations (IO) with focus on providing network access protection for the tactical Internet.</li> <li>- Enhance commercial PCS systems to provide cellular range extension. Demonstrate advanced networking capabilities using potential future digital radio technology in an airborne configuration</li> </ul>	
<b>Total</b>	<b>9254</b>	
<b>Project AH92</b>		
<b>Page 3 of 6 Pages</b>		<b>Exhibit R-2 (PE 0602782A)</b>

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602782A Command, Control, Communications

PROJECT

AH92

Technology

## FY 1999 Planned Program:

- 3900 -Continue development of solutions to address problems of mobile IP hosts spread across different IP nets in hostile environments. Investigate mobile ATM and resource allocation in mixed (ATM/IP/N-ISDN) networks.
- 2983 -Apply SERAT technology to ground environments, and experiment with structure-tuned antenna technology. Evaluate/demonstrate an SHF OTM satellite communications (SATCOM) self steering antenna capability.
- - Complete development of the integrated photonic control system for single/multi panel phased arrays, and integrate/demonstrate on a single panel phased array antenna.
- - Continue efforts to expand the system performance models and provide virtual communications systems models that support man-in-the-loop evaluations.
- 2952 - Demonstrate peer to peer CDMA PCS capability without base stations using handsets with attached host computers (supports next generation soldier PCS).
- Continue development of protection techniques for the tactical Internet expanding the effort to address intrusion detection and host level protection.
- Continue experimentation with commercial PCS technology and military backhaul for PCS for the digital battlefield communications advanced technology demonstration. Enhance commercial PCS waveforms to eliminate vulnerabilities.

Total 9925

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
8584	8042	9240	9907
8830	7863		
-304			
8526	7863	9254	9925

Project AH92

Page 4 of 6 Pages

Exhibit R-2 (PE 0602782A)

227

Item 20

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602782A Command, Control, Communications

PROJECT

A779

Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A779 Command/Control (C2) and Platform Electronics Technology	4604	7113	7584	8255	8227	8524	8705	8892	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is the exploration of new concepts and techniques in command/control and platform electronics integration to achieve new and enhanced military functional capabilities. Emphasis is on mission planning, rehearsal, execution and monitoring, precision navigation and landing, command and control, and integration with the evolving digital battlefield. New enabling technologies which support the current thrusts are also explored, such as advanced controls and displays, voice interactive technology, 3D visualization, decision aids and tactical planning aids, data transfer, distributed data bases advanced open system architectures, and visionic technology and integration concepts, which contribute to digitization of the battlefield and provide command and control on the move. The project serves as a direct technology feed to the following advanced warfighting experiments (AWEs), advanced technology demonstrations (ATDs), advanced concept technology demonstrations (ACTDs) and Defense technology objectives (DTOs): Task Force XXI (TF XXI) and Division (DIV) XXI AWEs, Battlespace Command and Control (BC2) ATD, Rapid Battlefield Visualization ACTD, Battlefield Awareness and Data Dissemination ACTD, Joint Countermine ACTD, Consistent Battlespace Understanding DTO; Forecasting, Planning, and Resource Allocation DTO; and Integrated Force Management DTO.

**FY 1996 Accomplishments:**

- 2240 - Developed and demonstrated GPS/sensor integration technologies, reducing the impact of GPS vulnerabilities.
  - Evaluated proposed improvements to digital terrain model (DTM) technologies via simulation.
  - Implemented alternative GPS satellite selection algorithms and validated performance for on/near ground level application (soldier, ground vehicle, helicopter at nap-of-the-earth).
- 2364 - Added environmental features to aircraft mission rehearsal (AMR) (clouds, fog, shadows, etc.), threat information (e.g. threat domes) and other objects as overlays to the real satellite images.
  - Conducted initial multi-sensor (inertial barometric, doppler, GPS) differential GPS precision approach and landing test while operating in the selective availability/anti-spoof (SA/AS) mode.

Total 4604

**FY 1997 Planned Program:**

- 4060 - Integrate improved DTM technology with a precision navigation system with enhanced electronic countermeasure protection.
  - Initiate development of a real-time multi-sensor differential GPS (DGPS) precision approach and landing concept to support operation during periods of temporary loss due to jamming or outages and including a data link to provide both secure and electronic counter-countermeasures capabilities.

Project A779

Page 5 of 6 Pages

Exhibit R-2 (PE 0602782A)

228

Item 20

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0602782A Command, Communications  
Technology

PROJECT

## 2 - Applied Research

A779

## FY 1997 Planned Program: (continued)

- 3053 - Integrate emerging technologies to demonstrate concepts which significantly enhance battlespace awareness and enable commanders and their staffs to electronically interface to the battlespace in an effective and intuitive manner. Technologies to be integrated include: computer/graphics hardware to support real-time 3D rendering of information; hardware and algorithms to facilitate natural human/machine interfaces [natural language (NL), touch and gestures, and large screen displays]; and software to implement battle planning (BP) functions.

Total 7113

## FY 1998 Planned Program:

- 3638 - Demonstrate platform positioning accurate to 1-3 meters to enhance situation awareness, in all environments (electronic counter measures, nap of earth (NOE)) with registration to digital terrain modeling. Conduct a technical evaluation of a real-time integrated DGPS/multi-sensor precision approach and landing system.
- 3946 - Demonstrate a battlespace planning and visualization system that integrates emerging technologies with existing DoD systems to enhance battlespace awareness and facilitate tactical assessment, forecasting, information visualization, course of action analysis and other critical C2 functions. The resulting system will provide real time planning, rehearsal and monitoring capabilities to commanders, analysts and staff.

Total 7584

## FY 1999 Planned Program:

- 3179 - Design and develop system configurations and prepare system specifications for the integration of the precision navigation system with visionic technology, imagery database, and terrain databases. Demonstrate to the user community an integrated real-time DGPS/multi-sensor landing system.
- 5076 - Develop and demonstrate a battle planning and visualization (BPV) system that integrates multiple existing DoD systems with emerging planning and user interface technologies to enhance all-echelon battlespace awareness. The BPV system will provide real-time/ near real-time hyperlinks to multiple battlefield information sources and innovatively display and interact with commanders and staff to accelerate and improve the commander's nine-step planning process. Forecasting, continuous planning/scheduling, interactive 3-D exploration of the battlespace, voice interaction and other advanced capabilities will be provided and stressed in exercises and field experiments.

Total 8255

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
4620	7265	7739	8017
4748	7113		
-144			
4604	7113	7584	8255

Project A779

Page 6 of 6 Pages

Exhibit R-2 (PE 0602782A)

229

Item 20

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE
BUDGET ACTIVITY										February 1997
PE NUMBER AND TITLE										
2 - Applied Research										
0602783A Computer and Software Technology										
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	3843	6500	679	337	1234	0	0	0	0	12593
DY10 Computer and Information Science Technology	2099	2269	679	337	1234	0	0	0	0	6618
A094 Tactical Software Technology	1744	4231	0	0	0	0	0	0	0	5975

**Mission Description and Budget Item Justification:** This program element develops and applies software technology to improve the performance and reduce the cost of computer software for Army tactical, strategic, and administrative information systems, tactical embedded real-time systems, high performance computational technology, and simulation technology. Tactical software technology efforts capitalize on computationally intensive approaches that exploit the rapidly evolving capabilities of emerging computer technology. Focus is on providing general solutions that can be applied to a wide variety of specific problems. Current examples include information distribution paradigms for constrained environments (e.g., bandwidth or security limited but not computationally limited), for application to tactical systems. Further specific concentrations are on applications to support tactical information distribution for situation awareness and interoperability of tactical systems. In the computer and information science technology areas, the efforts exploit advances in computer and communication technologies, and develop and modernize standard information management systems to support the soldier. The program addresses technical issues in the development of the Army's information mission areas of automation, communication, visual information, records management, and publication systems. In addition, the program investigates the infrastructure in communications and computers to support the information and communications needs of weapons technology. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan and Project Reliance. This program is managed primarily by the Army Research Laboratory (ARL). Efforts in this program element include non-system specific development efforts pointed toward specific military needs and therefore are appropriate to Budget Activity 2.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602783A Computer and Software Technology

PROJECT

DY10

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DY10 Computer and Information Science Technology	2099	2269	679	337	1234	0	0	0	0	6618

**A. Mission Description and Justification:** This project provides for the adaptation and application of research for the development and modernization of standard Army computer, command and control, and information systems. The project addresses technical issues in the development of an information architecture which will interconnect regional, local, and end user computing services resulting in a fully connected information management system with minimum data storage and maximum data access. The objectives of this project are to improve computer and communication system efficiencies by exploiting emerging technologies to reduce system development and maintenance costs and time, and to support modernization efforts of computing and communications hardware and software presently used in Army deployments throughout the world in both tactical and non-tactical environments. In addition, this project will facilitate transition to Ada, where applicable, for Army systems software development and achieve significant software reuse across Department of Defense (DoD) systems. This project also includes the application of intelligent system techniques in such areas as medical and maintenance diagnostics. New techniques, which include fuzzy logic and neural networks, will allow for expansion of applications and an increased focus on predictive application. Both medical and maintenance diagnostics applications of intelligent systems techniques need exploration for identification of high payoff applications. Intelligent decision support has the potential for significant military impact in these areas. The potential payoffs of this project are: measurable improvements in productivity and quality; reductions in utilization of life cycle resources by institutionalizing software management procedures and practices with savings in development and maintenance costs; increased communication systems capacity; responsiveness, reliability, interoperability, availability, and maintainability.

**FY 1996 Accomplishments:**

- 2099 - Identified candidate medical and maintenance diagnostics applications of advanced intelligent systems techniques.
- Demonstrated the capabilities of self-describing databases for direct database to database information exchange using the U.S. message text formats.
- Created an electronic meeting system (EMS) environment that can be accessed by geographically distributed users over the Internet or dial-up modem.
- Began to transition the computer aided prototyping system (CAPS) rapid prototyping environment into the Army Materiel Command life cycle software engineering centers and other software development agencies.

Total 2099

**FY 1997 Planned Program:**

- 2236 - Develop prototype medical and maintenance diagnostics applications using intelligent system techniques.
- Develop concepts to be used in formulating DoD policy and in developing or procuring systems for a unified DoD records management process.
- Extend records management research to incorporate data warehousing concepts and techniques into Army information systems and C3I applications.
- Develop testbed for the creation, testing, and analysis of computer and information-based technologies in system design and evolution to meet warfighter information requirements.

Project DY10

Page 2 of 5 Pages

Exhibit R-2 (PE 0602783A)

231

Item 21

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>2 - Applied Research</b>	<b>0602783A Computer and Software Technology</b>	<b>February 1997</b>	<b>DY10</b>
<b>FY 1996 Accomplishments: (continued)</b>			
	- Use group systems in a distributed mode with one or more Army commands.		
33	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total			2269
<b>FY 1998 Planned Program:</b>			
• 350	-Develop executable protocol specifications for and model the asynchronous transfer mode (ATM) protocol using very high speed integrated circuit hardware development language (VHDL).		
• 329	-Incorporate fully developed design database into distributed CAPS environment.		
Total			679
<b>FY 1999 Planned Program:</b>			
• 337	-Integrate change/merge capability for software subsystems into rapid prototyping testbed.		
Total			337
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	2134	2317	2501
Adjustments to Appropriated Value	2194	2269	2585
FY 1998 Pres Bud Request	-95		
	2099	2269	679
			337
Change Summary Explanation: Funding: FY 1998 funding reprogrammed (-1822) to higher priority requirements. FY 1999 funding reprogrammed (-2248) to higher priority requirements.			

Project DY10

Page 3 of 5 Pages

Exhibit R-2 (PE 0602783A)

232

Item 21

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602783A Computer and Software Technology

PROJECT

A094

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	1744	4231	0	0	0	0	0	0	0	5975

A094 Tactical Software Technology

**A. Mission Description and Justification:** This project addresses the development of software techniques to exploit the rapid advances in computer (hardware) performance that are becoming equally available to both the scientific and tactical community. The vast gap in computational performance and capabilities that used to exist between computer systems in these two domains is rapidly diminishing. Computer power previously available only to scientists and engineers is now becoming routinely available to the soldier and new concepts for one domain will be applicable to the other. This project ensures that a fresh perspective on the application of this power is maintained. It concentrates on computationally intensive paradigms for information distribution and manipulation in severely constrained environments such as those encountered in the use of existing low-bandwidth tactical radios. This includes the automation of information exchange and research into the tactical aspects of the data abstractions of military concepts. It identifies the necessary functions for a simulation capability that supports the evaluation of C4I battlefield architectures and digitization and communications science technologies for operational utility and predicted technical performance. This project seeks to develop the computational technology to achieve efficient utilization of advanced computer architectures at the tactical level. This project reflects movement of funds within ARL due to the Federated Laboratory Restructuring.

## FY 1996 Accomplishments:

- 1744 - Concluded research and development of adaptive information distribution and incorporated into prototype software. Provided real-time display of network performance. Evaluated success of approach under field conditions and transitioned to Combined Arms Command and Control Advanced Technology Demonstration.
- Demonstrated testing of executable specifications using VHDL.
- Developed techniques to passively monitor an automated information distribution environment to develop statistics to support research into heuristics to maximize network throughput, minimize network delay and respond to anomalies in network performance.

Total 1744

## FY 1997 Planned Program:

- 4197 - Demonstrate synthesis of communication interfaces using Very High Speed Integrated Circuit (VHSIC) Hardware Descriptive Language.
- Incorporate heuristics of network performance into software and transition to the Communication and Electronics Command Technology Demonstration.
- Develop software to support reasoning at multiple levels of abstraction which cooperatively process information from multiple heterogeneous databases.
- Conduct research to advance the science of rendering complex terrain, abstract data and battlefield objects in 3-D to avoid clutter and perceptual and cognitive overload.

Project A094

Page 4 of 5 Pages

Exhibit R-2 (PE 0602783A)

233

Item 21

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>2 - Applied Research</b>	<b>0602783A Computer and Software Technology</b>		<b>A094</b>
<b>FY 1997 Planned Program (continued):</b>			
34 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.			
Total	4231		
<b>FY 1998 Planned Program:</b> Project not funded in FY 98.			
<b>FY 1999 Planned Program:</b> Project not funded in FY 99.			
<b>B. Project Change Summary</b>			
FY 1997 President's Budget		FY 1996	FY 1997
Appropriated Value		1749	4321
Adjustments to Appropriated Value		1798	4231
FY 1998 Pres Bud Request		-54	
		1744	4231
			0
Change Summary Explanation: Funding: Beginning in FY 1998, funds reprogrammed to other Army requirements, in compliance with Army Science Board recommendation to increase reliance on commercial sources for advanced software technology.			

Project A094

Page 5 of 5 Pages

Exhibit R-2 (PE 0602783A)

234

Item 21

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602784A Military Engineering Technology

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	33734	38060	36422	40112	40322	40691	41767	42888	Continuing	Continuing
A855 Topography, Image Intelligence, and Space Technology	7729	8377	8929	9719	9487	9837	10051	10373	Continuing	Continuing
AH71 Atmospheric Investigations	5214	6551	5872	6135	6142	6406	6689	6885	Continuing	Continuing
AT40 Mobility & Weapons Effects Technology	10326	11140	12157	13751	13731	14230	14532	14850	Continuing	Continuing
AT41 Military Facilities Engineering Technology	4313	4195	3479	4376	4259	4033	4239	4348	Continuing	Continuing
AT42 Cold Regions Engineering Technology	4186	5425	3647	3567	3949	3634	3746	3862	Continuing	Continuing
AT45 Energy Technology Applied to Military Facilities	1966	2372	2338	2564	2754	2551	2510	2570	Continuing	Continuing

**Mission Description and Budget Item Justification:** The applied research conducted in this program provides technology in direct support of critical warfighter functions of mobility, countermobility, survivability, sustainment engineering, and topography needed to win on the modern battlefield. Research is conducted that supports the special requirements for battlefield visualization, tactical decision aids, weather intelligence products, and capabilities to exploit space assets. Key operational technologies developed are demonstrated to Army units under program element 0603734A (Military Engineering Advanced Technology). Results are tailored to support the material development, test, and acquisition community in evaluating the impacts of weather, terrain, and atmospheric obscuration on military operations. Research develops and exploits a wide range of innovative technologies and applies them to Defense unique planning, acquisition, revitalization, and sustainment processes. The goal of this research is to improve the efficiency and cost effectiveness as it relates to supporting the training/readiness/force projection missions in garrison and force sustainment missions in theaters of operation. The work in this program is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Defense Reliance Agreements on Civil Engineering and Battlespace Environments with oversight provided by the Joint Directors of Laboratories and Joint Engineers. These projects include non-system specific development efforts toward specific military needs and are therefore appropriate to Budget Activity 2.

Page 1 of 15 Pages

Exhibit R-2 (PE 0602784A)

235

Item 22

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602784A Military Engineering Technology

PROJECT

A855

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A855 Topography, Image Intelligence, and Space Technology	7729	8377	8929	9719	9487	9837	10051	10373	Continuing	Continuing

**A. Mission Description and Justification:** This project funds the technology to enhance the tactical commander's ability to visualize the battlefield in an easily understandable, 3-D perspective and exploit his knowledge of combat relevant intelligence as a force multiplier to conduct and win Force XXI operations across the operational continuum. Using tactical/strategic/space sensor data, together with terrain data bases as input, the technology program emphasizes automating the processes of detecting changes on the battlefield, identifying battle significant features, exploiting space based/remote sensing information (especially for deep operations and over denied areas), and integrating the impacts of the battlefield environment to significantly improve combat planning and operations. Development efforts will enable the commander to locate and position enemy and friendly forces in day/night all-weather conditions, provide crucial terrain data for command and control systems (C2) as well as modeling and simulation systems, and enhance the speed and accuracy of maneuver and weapon systems. The technology being developed will help those who move, shoot, and communicate on the battlefield to "fight smarter" through superior knowledge of the total battlefield terrain and environment. Work in this project will develop an effective architecture to reuse standard digital mapping software for assuring that digital topographic data can be processed correctly and consistently to increase system interoperability in Army and/or joint operations. Weather/atmospheric effects data is provided by Army Research Laboratory Project AH71 in this PE. This work is managed by the US Army Topographic Engineering Center, Alexandria, VA.

## FY 1996 Accomplishments:

- 7729 - Developed a semi-automatic knowledge based feature extraction and attribution capability.
- Developed an integrated virtual reality interface to the synthetic environment visualization system enabling soldiers to immerse in fog, haze, dust, clouds, smoke, flares, minefields, craters, and penetrable buildings.
- Developed standardized basic software tools for data import, export, formatting and display, and populate Army Software Reuse library to increase system interoperability in Army/joint operations.
- Developed and implemented capabilities of identification of man-made materials from hyperspectral data and signature data bases.

Total 7729

## FY 1997 Planned Program:

- 8377 - Develop a DoD standard coordinate conversion and datum transformation software package.
- Develop rapid, dynamic, 3-D battlefield environment/terrain visualization capabilities in a virtual reality environment for tactical and training applications.
- Develop distributed interactive simulation (DIS) browser supporting dynamic changes during simulation.
- Develop software and techniques for the identification of man-made materials using far infrared, hyperspectral data.

Total 8377

Project A855

Page 2 of 15 Pages

Exhibit R-2 (PE 0602784A)

236

Item 22

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602784A Military Engineering Technology

A855

## FY 1998 Planned Program:

- 8929 - Develop initial capability for automated feature attribution based on multispectral imagery data.
- Link 3-D model and texture library to database generation capability.
- Develop parametric modeling capability for battlefield terrain simulation.
- Develop procedures for ensuring that mapping, charting, and geodesy (MC&G) software adheres to the Defense Information Infrastructure.
- Develop new methods for portraying terrain analysis product reliability.

Total 8929

## FY 1999 Planned Program:

- 9719 - Develop automated feature extraction techniques and software.
- Integrate dynamic terrain architecture and synthetic environment models into a DIS stealth module.
- Develop standardized Army-wide MC&G software verification and validation procedures.
- Combine spatial recognition software and techniques with hyperspectral recognition software and techniques in a single testbed.

Total 9719

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
7922	8556	8915	9700
8142	8377		
-413			
7729	8377	8929	9719

Project A855

Page 3 of 15 Pages

Exhibit R-2 (PE 0602784A)

237

Item 22

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602784A Military Engineering Technology								AH71	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH71	Atmospheric Investigations	5214	6551	5872	6135	6142	6406	6689	6885	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project realistically models atmospheric effects on target acquisition, mobility, lethality, and survivability to provide weather limitations for design and operation of smart weapons, improved war game realism and tactics and improved intelligence preparation of the battlefield. It develops weather decision aids for the commander applying advanced computer techniques; incorporates new technology in meteorological sensor design; develops data fusion techniques to horizontally integrate data from advanced weather sensors and non-weather sensors into decision aids to enhance combat power on the battlefield. This project supports Project Reliance theater data fusion and prediction, atmospheric effects assessment, and battlefield environmental effects joint programs. The work is managed by the Army Research Laboratory (ARL), Battlefield Environment Directorate, White Sands Missile Range, New Mexico.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>3370 - Developed the capability for the Integrated Weather Effects Decision Aid (IWEDA) to use Battlespace Forecast Model field output, and to operate on Army common hardware.</li> <li>1844 - Exploited tactical geosynchronous meteorological satellite receiver technology to improve temporal resolution of battlefield/target area weather data.</li> <li>5214 - Developed prototype mobile profiling system (MPS) to be more deployable; improved MPS satellite profiles; and performed cost benefit analysis of mesoscale model for artillery accuracy.</li> <li>- Developed user interface for 2-dimensional limited complex terrain acoustic propagation model and integrated into real-time system architecture.</li> <li>- Integrated realistic hazard predictions from chemical-biological agent into war game models and visualization environment.</li> </ul>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>4425 - Complete the horizontal and seamless integration of the Integrated Weather Effects Decision Aid (IWEDA) into battlefield automated systems (BASs).</li> <li>- Develop an initial capability to forecast precipitation over the battlefield at tactical scales and add 4-D data assimilation and meteorological satellite initialization capability to the Battlespace Forecast Model.</li> <li>- Develop a prototype 4-D computer assisted artillery meteorology software system which provides trajectory and target area meteorology for close and deep attack systems; and develop a proof-of-concept downsized mobile profiling system.</li> <li>2066 - Develop user interface for 2-dimensional limited complex terrain acoustic propagation model.</li> <li>- Adapt direct numerical simulations for operational chemical/biological hazard modeling.</li> <li>- Enhance real-time scene visualization data transformation and rendering algorithms to support the integration of battlefield environment data in situation awareness displays.</li> </ul>											

Project AH71

Page 4 of 15 Pages

Exhibit R-2 (PE 0602784A)

238

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602784A Military Engineering Technology

AH71

## FY 1997 Planned Program: (continued)

- 60 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 6551

## FY 1998 Planned Program:

- 3304 - Extend the battlescale forecast model (BFM) forecast period to 48 hours and increase forecast accuracy by initializing with higher resolution Air Force or Navy model data.
    - Develop the capability for the All Source Analysis System, the Digital Topographic Support System, the Advanced Mobile Profiling System, and the Maneuver Control System to concurrently retrieve and incorporate weather information in Intelligence Preparation of the Battlefield, trafficability, aviation, and nuclear/biological/chemical applications.
    - Incorporate additional friendly and threat systems into the IWEDA data base.
    - Convert the Electro-Optical Tactical Decision Aids including weapon zones, target acquisition ranges, and thermal reversal to distributed client/server applications.
  - 2568 - Demonstrate the accuracy achieved by moving the battlescale forecast model (BFM) from the meteorology measuring set to indirect fire control computers and using the BFM to correct for met effects over the entire trajectory path of a projectile.
    - Develop a decision aid for displaying sound levels as a function of range and direction in the 2-dimensional turbulent boundary layer over flat terrain.
    - Examine and devise computationally efficient algorithms for dynamic weather data transformations for parallel and scaleable processing architectures with the dynamic terrain data transformations developed in this PE under Project A855.
- Total 5872

## FY 1999 Planned Program:

- 3436 - Evaluate converting the BFM to a nonhydrostatic model to improve predictions of severe weather.
  - Enhance forecaster decision aids with improved algorithms for predicting icing, turbulence, visibility, low cloud, and precipitation.
  - Transition an acoustic detection tactical decision aid using the BFM output to enable troops to determine the optimum placement of acoustic sensors for threat detection and optimum avenues of attack based on acoustic emissions and atmospheric conditions.
  - Incorporate an improved BFM for forecast representations in combat simulation and training including clouds, fog, severe weather, and improved battlefield aerosol diffusion at tactical scales.
- 1595 - Conduct evaluation of the system for target area and trajectory meteorology for close and deep attack systems and implement changes as needed; begin insertion of software upgrades such as improved satellite sounding retrievals.
- 1104 - Develop a user interface for 2-dimensional limited complex terrain/acoustic propagation model.

Project AH71

Page 5 of 15 Pages

Exhibit R-2 (PE 0602784A)

239

Item 22

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
2 - Applied Research	0602784A Military Engineering Technology	February 1997	AH71																									
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Use transient turbulence theory to develop a high resolution, complex terrain transport and diffusion model which will permit simultaneous calculation of meteorology and hazards prediction with significantly reduced computation time through eliminating the stepwise procedure of traditional approaches.</li> <li>- Investigate visualization techniques for fusing multiple information sources into a unified visualization of weather with the rapid, dynamic, 3-D battlefield environment/terrain visualization capabilities being developed in this PE under Project A855.</li> </ul>																												
Total	6135																											
<p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>5270</td> <td>6691</td> <td>5865</td> <td>6125</td> </tr> <tr> <td>Appropriated Value</td> <td>5416</td> <td>6551</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-202</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>5214</td> <td>6551</td> <td>5872</td> <td>6135</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	5270	6691	5865	6125	Appropriated Value	5416	6551			Adjustments to Appropriated Value	-202				FY 1998 Pres Bud Request	5214	6551	5872	6135
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	5270	6691	5865	6125																								
Appropriated Value	5416	6551																										
Adjustments to Appropriated Value	-202																											
FY 1998 Pres Bud Request	5214	6551	5872	6135																								

Project AH71

Page 6 of 15 Pages

Exhibit R-2 (PE 0602784A)

240

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602784A Military Engineering Technology

PROJECT

AT40

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT40 Mobility & Weapons Effects Technology	10326	11140	12157	13751	13731	14230	14532	14850	Continuing	Continuing

**A. Mission Description and Justification:** This project will provide warfighters the technologies for: rapid establishment and repair of lines of communications by both light and heavy engineers in support of US force deployment; optimal obstacle siting based on accurate predictions of enemy movement and the synergistic effects between obstacles and weapons systems; rapid obstacle and barrier creation; accurate assessments of battlefield mobility for maneuver commanders (and materiel developers during virtual prototyping); methodologies to predict coastal effects on logistics-over-the-shore (LOTS) operations; camouflage, concealment, and deception for fixed facilities to deny accurate acquisition and engagement by threat weapon systems; and designs, materials, and construction methods for battlefield, fixed, and forward base survivability against advanced conventional weapons and terrorist weapons. Civil engineering science and technology (S&T) in this project directly supports the Army's DoD Project Reliance S&T responsibilities in airfields and pavements, survivability and protective structures, and sustainment engineering. The work is managed by the US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

## FY 1996 Accomplishments:

- 5330 - Determined pressure/sinkage algorithms that account for soil's cyclic remodeling produced by multiple vehicle passages; validated and documented mobility data inference routines for the world's major climatic zones.
- Conducted two-dimensional laboratory experiments of concepts for rapidly emplaced breakwaters; incorporated engineer workload determination and resource allocation in theater infrastructure planning and assessment model.
- Performed subscale experiments of robust penetrators against layered targets; developed vulnerability analysis computer code for field evaluation and developed methodology and database for designing construction components to resist "very low" and "low" forced entry threat levels; developed analytical procedures for predicting component delay times to "medium" threat severity.
- 4996 - Conducted field evaluations of lightweight expedient surfacing for contingency operating surfaces and developed design and construction guidance for pavement joints and pavement smoothness; completed critical pavement durability parameter investigations.
- Evaluated concepts for deployable protective field fortifications for light forces; determined applicability of existing terrorist threat countermeasures for deploying forces and provided fully dynamic 3-D environmental information base procedures for infrared (IR) signatures; developed Camouflage, Cover, and Deception (CCD) measures for Army aviation fixed/long-dwell facilities.
- Developed precise techniques to predict the effects of localized, point-of-attack target damages on entire structures; conducted field experiments of assault breaching and obstacle creation technologies and developed and integrated knowledge-based decision making algorithms for obstacle placement into obstacle planning software (OPS).

Total 10326

Project AT40

Page 7 of 15 Pages

Exhibit R-2 (PE 0602784A)

241

Item 22

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE <b>0602784A Military Engineering Technology</b>	PROJECT <b>AT40</b>

  

**FY 1997 Planned Program:**

- 5857 - Complete development of first generation robust theoretical mobility model incorporating non-linear vehicle-terrain interaction; complete development of automated methods to rapidly derive, from standard available data, world-wide high-resolution mobility model input data.
- Conduct 3-D, lab-scale experiments of rapidly emplaced breakwater concepts to support logistics-over-the-shore operations.
- Develop design criteria for complex layered antipenetration systems to defeat large penetrating munitions and develop methodology for designing construction components to resist forced entry.
- 5283 - Demonstrate advanced materials for construction of operating surfaces on soft soils; provide guidance for design, placement, and procurement of materials for soft soil stabilization for integration into TM 5-430-00-2 and synthesize theoretical equations, laboratory experiment results, and field data into a preliminary interactive analytical pavement response and performance model.
- Complete protective concepts for US Army aircraft parked in forward battle areas, criteria and guidance for the protection of deploying forces from sabotage attack, and concepts for protective shelters packages for light forces and conduct fixed/long-dwell facility decoys experiments.
- Develop techniques to predict demolition's effects on reinforced concrete and rock structural targets and evaluate integrated obstacle planning software (OPS) algorithms during a full-scale field training exercise.

Total 11140

  

**FY 1998 Planned Program:**

- 12157 - Develop simplified survivability analysis procedure for field fortifications; develop camouflage materials and light-weight material revetments for protection of aviation assets; develop designs for fixed/long-dwell facility decoys.
- Develop improved analytic procedures for predicting reflections from geologic layers and the ground surface due to subsurface detonations; develop and validate hardening techniques for walls to resist mortar threats.
- Conduct 3-D lab-scale experiments of rapidly emplaced breakwater concepts for logistics-over-the-shore operations; develop initial methodology for rapid generation of river basin models for hydrologic forecasting.
- Develop advanced pavements materials characterization and classification procedures; develop and validate algorithms to predict performance of expedient airfield pavements.
- Validate algorithms to infer structural attributes that are not available but required for bridge assessments; develop techniques for rapid soils properties determination; evaluate techniques for rapid repair of damaged bridges; develop model to predict roadway deterioration under military unique loads in emerging countries.
- Initiate development of algorithms for rainfall distribution effects on soil moisture/strength and vehicle traction; reconfigure NATO Reference Mobility Model for replication of dynamic deformable soil-tire/track interactions; evaluate epoxy/polymer materials for expedient strengthening of roadway surfaces.

Total 12157

Project AT40

Page 8 of 15 Pages

Exhibit R-2 (PE 0602784A)

242

Item 22

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602784A Military Engineering Technology

PROJECT

AT40

## FY 1999 Planned Program:

- 13751 - Develop techniques for troop evaluations of the structural integrity of small protective emplacements; evaluate concepts for application of multispectral CCD material combinations to fixed/long-dwell assets; correlate target structural damage with target type, geometry, and materials and demolition method.
- Develop integrated procedures for the design and analysis of above-ground and buried facilities to resist both external and internal detonations; complete static and dynamic laboratory experiments and associated analyses of square concrete structural components with large span-to-thickness ratios; develop and validate hardening techniques for roofs to resist mortar threats.
- Design specifications for rapidly installed breakwater; incorporate algorithms into Riverine Analysis Model to calculate probability bands for hydrologic predictions; incorporate real-time nowcast data analyses into logistics-over-the-shore planning model.
- Establish criteria and procedures for the use of local materials and equipment for construction of expedient airfields; validate analytic models capable of replicating dynamic pavements and materials response under vehicle loadings and multiple tire interactions.
- Develop an analytic capability for automated assessment and load classification of bridges; establish procedures for use of soil vitrification for soil stabilization; complete initial software for synergistic allocation of engineer assets within resource constraints to transportation infrastructure maintenance, repair, and construction tasks.
- Develop soil constitutive relationships describing the traction performance of tires operating in coarse-grained soils; develop stress distribution model for tire/track/soil contact area; conduct in-situ field experiments to measure normal and tangential forces occurring at the vehicle/soil interface.

Total 13751

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
10520	11403	12642	13756
10812	11400		
-486			
10326	11140	12157	13751

Project AT40

Page 9 of 15 Pages

Exhibit R-2 (PE 0602784A)

243

Item 22

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602784A Military Engineering Technology								AT41	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT41	Military Facilities Engineering Technology	4313	4195	3479	4376	4259	4033	4239	4348	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project exploits innovative developments in a wide range of technologies to achieve critically needed cost reductions in Army facility life cycle processes (infrastructure planning, assessment, design, construction, revitalization, sustainment, and disposal). Current Army infrastructure operations, maintenance, and repair costs alone are about \$8.5 billion per year. The goal for the DoD Technology Area Plan is to reduce facility acquisition and maintenance and repair costs 15% by FY 2001 from a 1985 baseline. Meeting this critical goal is not possible without application of significant technology innovation. Products already developed and projected for the future have high civilian sector dual use potential. These include innovations in composite materials, concurrent engineering, collaborative decision support, corrosion resistant coatings, seismic vulnerability evaluations, and knowledge processing. Additionally, significant soldier retention benefits also accrue from providing professional work environments and high quality communities for military families. Under the DoD Project Reliance initiative, the Army is responsible for managing the conventional facilities research and development needs of all the military services through the Construction Engineering Research Laboratories, Champaign, Illinois.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2610 - Developed building engineering management system to provide holistic decision support for building maintenance and repair.</li> <li>- Evaluated smart roofing systems and construction materials recycling for design, repair and revitalization of Army facilities.</li> <li>- Developed concurrent engineering environment for facility design and construction to improve life cycle decision making.</li> <li>• 1703 - Tested pre-cast concrete wall connectors for seismic retrofit.</li> <li>- Provided collaborative performance support environment for knowledge workers to improve installation management.</li> </ul> <p>Total 4313</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4195 - Integrate installation commanders' facility maintenance management system data warehouses for optimal resource allocation with special emphasis on automated inspection procedures.</li> <li>- Demonstrate concurrently engineered facility delivery process that facilitates multiple discipline interaction.</li> <li>- Develop criteria for recycling construction and demolition materials.</li> <li>- Develop conductive concrete for electromagnetic shielding applications for secure facilities.</li> </ul> <p>Total 4195</p>											

Project AT41

Page 10 of 15 Pages

Exhibit R-2 (PE 0602784A)

244

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602784A Military Engineering Technology

AT41

## FY 1998 Planned Program:

- 3479 - Demonstrate the Open Collaborative Engineering framework for modular design and integrated military facility management.
- Initiate development of ferromagnetic active tags to monitor status of military structural building systems.
- Develop seismic evaluations and rehabilitation methods for military steel frame buildings.

Total 3479

## FY 1999 Planned Program:

- 4376 - Enhance the Modular Design for Systems to accommodate 80% of Army facility types.
- Initiate development of self-repairing facings, coatings, and membranes for military buildings containing distributed reactive materials in inert casings which when released enable self-repair.
- Develop criteria for upgrading seismically vulnerable concrete frame barracks structures.
- Document effectiveness of isolation and strengthening methods for protecting critical equipment.

Total 4376

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	4332	4285	3965	4358
Adjustments to Appropriated Value	4453	4195		
FY 1998 Pres Bud Request	-140			
	4313	4195	3479	4376

Change Summary Explanation: Funding- FY1998 funding reprogrammed (-486) to higher priority requirements.

Project AT41

Page 11 of 15 Pages

Exhibit R-2 (PE 0602784A)

245

Item 22

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602784A Military Engineering Technology								AT42	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT42	Cold Regions Engineering Technology	4186	5425	3647	3567	3949	3634	3746	3862	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project is the only DoD exploratory development program focused on the knowledge base and engineering principles needed to sustain an effective war fighting force in winter and the cold regions of the world, including combat support, combat engineering and base/facility construction, operation and maintenance. Research directly lowers high life-cycle costs and extends the abbreviated service life of DoD facilities and provides the basis for extending the operability of forces and materiel in cold weather. Research supports readiness and effectiveness of DoD conventional, light and special operations forces in the Arctic, Alaska, Scandinavia, Korea, Japan, Europe, the US northern tier and remote/high altitude environments. This program is a source of special technologies for civilian engineering and environmental applications not obtainable through the private sector and is essential to improving US projection of power and operational capabilities in cold weather areas of the world. The work is managed by the US Army Cold Regions Research and Engineering Laboratory, Hanover, NH.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>4186 - Validated millimeter-wave radar backscatter model, and demonstrated dynamic scene rendering for the Smart Weapons Operability Enhancement (SWOE) Science and Technology Objective (STO).</li> <li>- Integrated deep snow model into the Comprehensive Army Mobility Model System (CAMMS); created cold weather effects data bases for Janus wargame analysis model.</li> <li>- Developed prototype guidelines for long-lasting, low-maintenance coatings and application procedures for concrete, brick, and masonry buildings supporting military infrastructure repair, operation, and design cost reduction programs.</li> </ul> <p>Total 4186</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>4541 - Complete integrated mobility modeling for snow, thawing soil and surface icing conditions for engineer mission analysis.</li> <li>- Complete prototype environmental features signature model for simulation of advanced sensing systems.</li> <li>- Validate prototype materials for low-temperature repairs to concrete and provide design guidance for use of low quality material in pavements for expedient use in theater of operations supporting military infrastructure repair, operation, and design cost reduction programs.</li> <li>884 - Define effects of snow and frozen ground on mine detection mechanisms and upgrade ability to characterize and forecast streamflow resulting from snowmelt and its impact on bridging and mobility.</li> </ul> <p>Total 5425</p>											

Project AT42

Page 12 of 15 Pages

Exhibit R-2 (PE 0602784A)

246

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602784A Military Engineering Technology

AT42

## FY 1998 Planned Program:

- 3647 - Generate dynamic integrated IR/MMW winter backgrounds for synthetic scene simulation .
- Develop winter effects conditions models for use in Army combat simulations.
- Develop methods for expedient stabilization of thawing soils for theater of operations main supply route development and maintenance.

Total 3647

## FY 1999 Planned Program:

- 3567 - Validate models to spatially distribute winter terrain effects for Army simulations .
- Integrate single and dual mode IR/MMW sensor-environment models in Army virtual proving ground software.
- Begin to develop techniques for expedient enhancement, maintenance, and operation of airfields in winter conditions.

Total 3567

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

4168

4292

-106

4186

FY 1997

4541

5425

5425

FY 1998

3632

3647

FY 1999

4548

3567

Change Summary Explanation: Funding: FY1997- Funding increased by Congress (+884) to define effects of snow and frozen ground on mine detection and to upgrade ability to characterize and forecast streamflow resulting from snowmelt and its impact on bridging and mobility.

FY1999- Funding reprogrammed (-981) to higher priority requirements.

Project AT42

Page 13 of 15 Pages

Exhibit R-2 (PE 0602784A)

247

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602784A Military Engineering Technology

PROJECT

AT45

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AT45 Energy Technology Applied to Military Facilities	1966	2372	2338	2564	2754	2551	2510	2570	Continuing	Continuing

**A. Mission Description Justification:** Energy is essential for the modern Army to meet its mission. The research conducted in this project provides the technology for providing energy efficient facilities, adapting new energy source technologies to military facilities, applying cost effective renewable energy technologies for Army uses, and improving the efficiency of Army central energy plants. Research focuses on leveraging industry technology investments and integrating a broad range of advanced technologies into a comprehensive system to meet the specialized needs of the Army utilities systems. Activities include modeling and simulation of thermal loops and electrical systems, developing new analytic techniques, and incorporating new system designs and hardware in conjunction with industry. Research products/systems are integrated in a "low energy" model installation program. Research products are transferred to the field and used in new construction and in upgrades of existing facilities. The Executive Order implementing the Energy Policy Act of 1992 requires the Army to reduce energy consumption 20% by 2001 from the 1985 baseline. The work is managed by the Construction Engineering Research Laboratories, Champaign, Illinois.

## FY 1996 Accomplishments:

- 1966 - Developed computer assisted training modules for achieving energy efficient facilities.
- Applied energy efficient commercial/off-the-shelf (COTS) lighting technologies to Army facilities.
- Developed refined cost-benefit model for prioritization of energy conservation alternatives applicable for DoD facilities.
- Developed energy usage-workforce productivity relationship model.

Total

1966

## FY 1997 Planned Program:

- 2372 - Provide Department of Energy a repository of designs for standard military facilities.
- Develop methods for adopting fuel cell technology in Army energy plants.
- Develop advanced digital control for heating, ventilation, air-conditioning (HVAC) to improve accuracy, reduce energy costs, and improve indoor air quality.
- Complete application guidelines for emerging natural gas based cooling systems.

Total

2372

Project AT45

Page 14 of 15 Pages

Exhibit R-2 (PE 0602784A)

248

Item 22

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602784A Military Engineering Technology

PROJECT

AT45

## FY 1998 Planned Program:

- 2338 - Develop methodology to determine the optimal mix of centralized and decentralized energy supply options for Army facilities.
- Complete application guidelines for phosphoric acid fuel cell technology.
- Develop methodology for optimizing natural gas distribution systems for Army facilities.
- Initiate development of virtual reality based design tools for building envelope, electrical and mechanical systems.

Total 2338

## FY 1999 Planned Program:

- 2564 - Complete self-tuning adaptive control algorithms for utility plant automation.
- Develop methodology for optimizing electrical distribution and supply to Army facilities.
- Develop concurrent engineering principles for community design concepts between electrical and mechanical building systems.

Total 2564

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2048	2422	2324	2546
2105	2372		
-139			
1966	2372	2338	2564

Project AT45

Page 15 of 15 Pages

Exhibit R-2 (PE 0602784A)

249

Item 22

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE		February 1997		
BUDGET ACTIVITY		PE NUMBER AND TITLE									
2 - Applied Research		0602785A Manpower/Personnel/Training Technology									
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		7254	9329	9014	9019	9016	9013	9010	9007	Continuing	Continuing
A790 Personnel Systems and Performance Technology		2554	3042	9014	9019	9016	9013	9010	9007	Continuing	Continuing
A791 Education and Training Technology		4700	6287	0	0	0	0	0	0	0	10987

**Mission Description and Budget Item Justification:** The objective of this program is to maximize soldier and unit performance based on research in leader development, selection and classification, and optimal training strategies. Research programs include training strategies for the digitized battlefield, training strategies in simulated environments, optimum designs of simulators and training devices to achieve maximum learning at minimum cost, and modernization of the selection and classification system to maintain warfighting capabilities in a downsized Army. Research in the PE is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. The projects include non-system specific development efforts pointed toward specific military needs and are therefore appropriate to Budget Activity 2. The majority of the research conducted in the PE transitions to Manpower, Personnel, and Training Advanced Technology (PE 0603007A) development. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). As a result of HQDA Redesign, ARI's research program has undergone major restructuring.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602785A Manpower/Personnel/Training

PROJECT

A790

## Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A790 Personnel Systems and Performance Technology	2554	3042	9014	9019	9016	9013	9010	9007	Continuing	Continuing

**A. Mission Description and Justification:** The objectives of this project are to provide the scientific basis for improved methods for leader assessment and development, enhanced selection and classification procedures to ensure the right person is placed in the right job, and the impact of stability operations on personnel issues (e.g., career commitment). Research under this project supports the manpower and personnel Defense technology area. Beginning in FY1998, this project is restructured to include training research.

## FY 1996 Accomplishments:

- 2554 - Validated new measures of performance-related aptitude, leadership, and stress tolerance.
- Modeled the development of commander knowledge and skills.
- Developed methods for measuring the leadership knowledge acquired through operational experience.
- Identified economic, family support and career commitment factors that influence a reservist's decision to volunteer for stability operations.

Total 2554

## FY 1997 Planned Program:

- 3042 - Develop models of impact of peacekeeping operations on career development and commitment.
- Complete development of new measures of aptitude related to enlisted leader performance requirements.
- Design techniques for developing and training decision making skills.
- Develop new measures for assessing leadership potential in officer candidates.
- Identify preliminary set of leader attributes needed in 2010 and beyond.

Total 3042

## FY 1998 Planned Program:

- 9014 - Develop prototype training methods and performance assessment instruments in support of the digitized battlefield.
- Determine simulator fidelity requirements in support of Aviation Combined Arms Tactical Trainer.
- Demonstrate training methods in virtual environments for fire teams.
- Generate list of representative, Army-wide, 21st Century Non-Commissioned Officer performance requirements.
- Develop structural models of the impact of stability operations on personnel issues.

Total 9014

Project A790

Page 2 of 5 Pages

Exhibit R-2 (PE 0602785A)

251

Item 23

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
2 - Applied Research	0602785A Manpower/Personnel/Training Technology	A790																										
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>9019 - Evaluate prototype training methods and performance assessment instruments in support of mounted and light infantry forces on the digitized battlefield.</li> <li>- Develop training strategies for reconfigurable rotary-wing simulators.</li> <li>- Demonstrate speech recognition in foreign language tutor.</li> <li>- Develop attribute list needed to meet NCO performance requirements identified for the 21st Century.</li> <li>- Develop training strategies for the dismounted soldier in simulated environments.</li> </ul> <p>Total 9019</p>																												
<p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>2582</td> <td>3107</td> <td>3224</td> <td>3704</td> </tr> <tr> <td>Appropriated Value</td> <td>2653</td> <td>3042</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-99</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>2554</td> <td>3042</td> <td>9014</td> <td>9019</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	2582	3107	3224	3704	Appropriated Value	2653	3042			Adjustments to Appropriated Value	-99				FY 1998 Pres Bud Request	2554	3042	9014	9019
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	2582	3107	3224	3704																								
Appropriated Value	2653	3042																										
Adjustments to Appropriated Value	-99																											
FY 1998 Pres Bud Request	2554	3042	9014	9019																								
<p>Change Summary Explanation: Funding: This project was restructured to include training research (FY1998, +5790; FY1999, +5315) starting in FY 1998..</p>																												

Project A790

Page 3 of 5 Pages

Exhibit R-2 (PE 0602785A)

252

Item 23

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

2 - Applied Research

PE NUMBER AND TITLE

0602785A Manpower/Personnel/Training

Technology

PROJECT

A791

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A791 Education and Training Technology		4700	6287	0	0	0	0	0	0	0	10987

**A. Mission Description and Justification:** The objectives of this project are to provide the behavioral technologies required for the development of effective individual and collective (unit) training strategies using simulation-based synthetic environments. Research conducted in this project builds on recent advances in the cognitive sciences and will provide an empirical basis for improved collective (unit) training strategies and techniques for brigade and below, with focus on the digitized battlefield of the future. It will develop training methods to improve night operations, individual training strategies exploiting "virtual reality" technology for training and rehearsal of warfighting missions and stability operations, and determination of requirements for cost-effective simulator training on selected aviation tasks. Research under this project directly supports the training systems Defense technology area. Beginning in FY1998, this research is restructured to project A790.

**FY 1996 Accomplishments:**

- 4700 - Designed and tested methodology for developing brigade and multi-service training and assessment programs.
- Determined display resolution requirements for flight simulator-based task training.
- Extracted training lessons learned from Mounted Battlespace Battle Lab's "Focused Dispatch" Advanced Warfighting Experiment.
- Developed experimental training techniques to improve thermal target acquisition skills.
- Demonstrated and assessed capability to conduct team training in virtual reality environments.

Total

4700

**FY 1997 Planned Program:**

- 6287 - Determine simulator fidelity required for command and control in networked aviation training systems.
- Design training and performance evaluation techniques to support Force XXI digital capabilities.
- Develop prototype simulation-based immersive training techniques for dismounted combatants.
- Complete development of prototype training techniques to improve combat vehicle identification utilizing 2nd generation FLIR (forward looking infrared) sensors.
- Demonstrate technologies to improve the effectiveness and efficiency of Individual Ready Reserve (IRR) at mobilization.

Total

6287

**FY 1998 Planned Program:** Program restructured to project A790.**FY 1999 Planned Program:** Program restructured to project A790.

Project A791

Page 4 of 5 Pages

Exhibit R-2 (PE 0602785A)

253

Item 23

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602785A Manpower/Personnel/Training Technology	A791	
<b>B. Project Change Summary</b>			
FY1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	4716	6421	7450
Adjustments to Appropriated Value	4847	6287	8194
FY 1998 Pres Bud Request	-147		
	4700	6287	0
Change Summary Explanation: Funding: As a result of ARI restructuring, training research is reported in Project A790 beginning in FY1998.			

Project A791

Page 5 of 5 Pages

Exhibit R-2 (PE 0602785A)

254

Item 23

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

## 0602786A Logistics Technology

	COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		26995	21319	17196	18565	18478	18023	18468	18876	Continuing	Continuing
AH20 Mobility Equipment Technology		6980	0	0	0	0	0	0	0	0	6980
AC60 TRACTOR ZINC		0	3208	2034	2076	2156	957	974	992	Continuing	Continuing
AH98 Clothing and Equipment Technology		12144	9245	9102	9971	9713	10293	10582	10824	Continuing	Continuing
AH99 Joint Services Food/System Technology		5198	4299	4368	4615	4714	4813	4913	5020	Continuing	Continuing
DJ10 Combat Rations Quality Enhancement		1197	2937	0	0	0	0	0	0	0	4134
D283 Airdrop Advanced Technology		1476	1630	1692	1903	1895	1960	1999	2040	Continuing	Continuing

**Mission Description and Budget Item Justification:** This program element provides technology for the individual soldier and airdrop technology. Unusual demands will be placed on the soldier and soldier support systems by future hardware. In order to achieve required individual performance, mobility, and effectiveness, there must be associated technology developments evolving in soldier support equipment, supplies, and systems to make them smaller, lighter, more reliable and durable, more survivable, less manpower intensive, affordable, and more mobile. Technology efforts on clothing and equipment and cutting edge technologies for high pressure airbeam supported shelters provide enhanced warfighter protection from both combat threats and from the natural field environment. The Joint Services Food/System Technology program supports all Military Services, the Special Operations Command, and the Defense Logistics Agency with research and development of high impact/high payoff technologies for military food products, packaging, and combat food service equipment. The Combat Ration Quality Enhancement project establishes quality quantification parameters and criteria to minimize physical, chemical, and nutritional degradation of combat rations, thus maintaining/enhancing acceptance and consumption by the military community. Similarly, work on advanced airdrop technology supports all Services' requirements for air dropping larger combat and logistics loads while improving delivery accuracy, minimizing vulnerability of aircraft and reducing life cycle costs. This is a critical capability for rapid force projection, particularly into hostile environments. The focus of investigation in mobility equipment technology included landmine detection and neutralization, counter-surveillance, and low-signature, high efficiency mobile electric power sources. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. It adheres to Tri-Service Reliance agreements on clothing, textiles, and operational rations and field food service equipment, with oversight and coordination provided by the Joint Directors of Laboratories. There is no unwarranted duplication of effort among the military departments. Efforts are coordinated with those in PE 0603001A (Logistics Advanced Technology). The program is managed by the U.S. Army Natick Research, Development and Engineering Center, Natick, MA. The Night Vision and Electronic Sensors Directorate of the Communications-Electronics Command managed the Mobility Equipment Technology project which ended in FY 1996. Research in this program element includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2.

Page 1 of 14 Pages

Exhibit R-2 (PE 0602786A)

255

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602786A Logistics Technology								AH20	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH20	Mobility Equipment Technology	6980	0	0	0	0	0	0	0	0	6980
<p><b>A. Mission Description and Justification:</b> This exploratory development program addressed the need for advanced combat support and combat service support equipment and material. The project was directed toward providing the technology to solve deficiencies in the Army mission areas of engineer-mine warfare and combat service support. It included efforts in low-cost signature reduction, counter-surveillance, deception, survivability, countermine, mobile electric power, and environmental control. Beginning in FY 1997 this work was restructured to PE 0602712A (Countermine Applied Research)/ Project AH24 and PE 0602705A (Electronics and Electronic Devices)/ Project AH11.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>6107 - Developed multisensor deception materials and collected field data to validate representation of low observables in target acquisition/wargame simulations.</li> <li>- Evaluated imaging infrared (IR) and frequency agile radar for mine detection on mobile combat vehicle testbed; developed preliminary design of explosive mine neutralization system.</li> <li>- Conducted castform simulations to develop scenarios for countermine demonstration; selected software architecture and insertion points for integrating mine/countermine functions in distributed interactive simulation (DIS) environment.</li> <li>873 - Demonstrated fuel cell power sources at 50W and 150W levels; tested and evaluated fuel cells.</li> <li>- Initiated fabrication and testing of portable, JP-8 fuel burning 1.5kW engine driven generator set comprised of novel permanent and advanced fuel injection hardware.</li> </ul> <p>Total 6980</p> <p><b>FY 1997 Planned Program:</b> Project tasks restructured to PE 0602712A/AH24 and PE 0602705A/AH11.</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget Appropriated Value 7004 0</p> <p>Adjustments to Appropriated Value 7203 0</p> <p>FY 1998 Pres Bud Request -223 0</p> <p>FY 1998 Pres Bud Request 6980 0</p> <p>Project AH20</p> <p>Page 2 of 14 Pages Exhibit R-2 (PE 0602786A)</p>											

Page 2 of 14 Pages

Exhibit R-2 (PE 0602786A)

256

Item 24

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602786A Logistics Technology

PROJECT

AH98

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
		9245	9102	9971	9713	10293	10582	10824	Continuing	Continuing

**A. Mission Description and Justification:** This exploratory development effort improves soldier survivability and performance through significantly improved materials and new technology applications for combat clothing and personal equipment. Areas of emphasis include material development to improve: ballistic, flame, and directed energy protection; enhanced countersurveillance/camouflage; microclimate conditioning; materials/concepts for protection in arctic/desert environments; and improvements to lighten the soldier's load. Human factors research and simulation and modeling tools applicable to the soldier system are used to quantify soldier performance and determine optimal research and development (R&D) alternatives. In FY 1997, technology on selectively permeable membranes for chemical protection was restructured to DoD PE 0602384BP as part of the consolidated DoD Chemical/Biological Defense program.

## FY 1996 Accomplishments:

- 6601 - Investigated the optimization of parameters of components for multiple ballistic threat protection (fragments and small arms) to reduce weight and bulk while increasing performance of body armor for soldiers and police; determined viability of flexible ballistic protective materials system for small arms protection through analytical and experimental analysis.
- Developed first generation silk protein-based polymers for genetically engineered ballistic protective fibers.
- Optimized and scaled-up selected thermal signature reducing materials for personal camouflage.
- Inserted combined dye technology (for 532 nm) and broadband (694 through 1064 nm) dielectric technology into polycarbonate laser protective eyewear.
- 5543 - Integrated optimized, selectively permeable membranes and permeable fabrics into lightweight (20% less than standard overgarment), moisture vapor permeable textile systems for chemical protection for Joint Service Lightweight Integrated Suit Technology (JSLIST) P1 and Land Warrior.
- Investigated feasibility of incorporation of new carbonaceous fiber into existing nylon-cotton protective uniform fabrics to impart durable flame resistance; demonstrated electrically heated handwear with an optimized design of the controller/liner; defined the protective technology requirements for flame and thermal battlefield threats.
- Completed parametric analysis of proposed Force XXI Land Warrior component and module designs to support optimization of soldier performance and survival; provided modeling, simulation, and analysis support to clothing and textile development to quantify and maximize the viability/capability of proposed systems; provided critical soldier performance data for Integrated Unit Simulation System (IUSS) model; provided a first generation individual soldier simulation to support virtual simulation for Force XXI Land Warrior.
- Evaluated optimal designs for biomechanically efficient prototype footwear and developed protocol for military field testing; applied motion analysis techniques to assess soldier-clothing/equipment interface; validated 3D whole-body laser scanning methodology; developed prototype lightweight, modular microclimate cooling system.
- Fabricated and demonstrated full scale Large Area Night Maintenance Shelter using airbeam technology for the structural members.

Total 12144

Project AH98

Page 3 of 14 Pages

Exhibit R-2 (PE 0602786A)

257

Item 24

UNCLASSIFIED



**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT	
2 - Applied Research		0602786A Logistics Technology	AH98	
FY 1997 Planned Program:				
•	4865	- Conduct integration of optimized small arms protective technologies and fragmentation protective technologies leading to a 20-30% total weight reduction and evaluate against multiple ballistic threats.		
		- Evaluate ballistic protective properties of high-performance genetically engineered silk.		
		- Complete scale-up of additional thermal signature reducing materials and incorporate best candidates into personal camouflage and combat clothing.		
		- Synthesize and characterize improved nonlinear optical materials for incorporation into design configurations that provide maximum attenuation of agile laser energies; provide tunable laser eye protection using band blocking strategies.		
•	4380	- Establish military flame/thermal hazards and battlefield assessment for ground soldiers; develop appropriate protective strategies; integrate durable static dissipation characteristics in the environmental protective fabrics.		
		- Provide modeling, simulation and analysis to support the design of the Force XXI Land Warrior early user test; develop initial suite of modeling, simulation and analytic tools around integrated ballistics, heat stress and ground mobility to support systems performance and survivability assessments of emerging Land Warrior systems.		
		- Conduct field investigation of soldier performance in combat-related activities to validate lab findings on the soldier-clothing/equipment interface; perform lab-based biomechanical evaluations on prototype footwear and conduct small scale military field test to obtain user feedback and verification of evaluations on footwear characteristics; demonstrate and evaluate a lightweight modular vapor compression microclimate cooling system; complete proof of concept study for a lightweight non-electric complex compound microclimate cooling system.		
Total	9245			
FY 1998 Planned Program:				
•	5064	- Demonstrate advanced material system for protection against combined fragmentation and small arms threats (known ball threats up to/including 0.30 caliber) at a reduced areal density (weight) compared to current small arms protection, without significantly increasing other penalties.		
		- Increase expression levels of first generation silk protein, for genetically engineered ballistic SP-2LS materials, to 100mg/liter; demonstrate flame retardant fabric coating based on enzymatic polymer synthesis.		
		- Develop a site specific/rapid fabrication camouflage capability and demonstrate several prototype combat uniforms for special operations.		
		- Incorporate the best performing nonlinear materials for laser/ballistic eye protection into thin films or graded-density substrates and evaluate the optical attenuation they provide; continue nonlinear material characterization and synthesis efforts.		
•	4038	- Optimize flame retardant nylon fabric; produce yardage and prototype garments; develop flame/thermal model to predict the impact of flame resistant material system on the performance of the soldier in varying scenarios; establish baseline performance criteria and test methodologies for the wear life of the combat uniforms.		
		- Provide modeling, simulation and analytic tools to facilitate the cost and operational effectiveness analysis of Land Warrior and risk reduction and insertion of components into the Force XXI Land Warrior program.		
		- Finalize whole body scan protocols compatible with ANSUR 2-D database standards; complete modular head and face models for Integrated Headgear; fabricate prototype boots for field testing; demonstrate and evaluate a prototype lightweight non-electric microclimate cooling system.		
Total	9102			
Project AH98		Page 4 of 14 Pages		Exhibit R-2 (PE 0602786A)

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602786A Logistics Technology

PROJECT

AH98

## FY 1999 Planned Program:

- 5644 - Transition improved small arms protective material system to advanced development and/or as technology insertions to modify existing individual protective items; conduct optimization of new materials for next generation multiple ballistic threat protection (increased small arms, advanced fragmentation, and improved blast protection).
  - Develop silk-based fabric for ballistic protective applications.
  - Demonstrate combat uniform systems that further reduce the soldier's thermal signature from background levels and exhibit improved textile performance.
- 4327 - Using the best available materials and implementation strategies, assemble a broadband tunable protective device for laser/ballistic eye protection; continue investigations into material characteristics and nonlinear optical effects enhancement techniques.
  - Demonstrate combat uniform fabrics with durable multi-functional protection (e.g., flame retardant, water repellent, chemical protective, and camouflage printable).
  - Complete analytic assessment of Force XXI Land Warrior early user test.
  - Demonstrate custom clothing patterns from 3-D scan data; demonstrate a 10-15 percent reduction in the probability of occurrence of stress related, lower extremity disorders among ground troops wearing the new combat boots; complete proof of concept study for an individual body heating system.

Total 9971

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
12273	9464	9920	10635
12615	9245		
-471			
12144	9245	9102	9971

Project AH98

Page 5 of 14 Pages

Exhibit R-2 (PE 0602786A)

259

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602786A Logistics Technology								AH99	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
AH99	Joint Services Food/System Technology	5198	4299	4368	4615	4714	4813	4913	5020	Continuing	Continuing

**A. Mission Description and Justification:** This DoD program for which the Army has Executive Agency responsibility addresses high impact, high payoff food and food system technologies to support all military Services, Special Operations Command, and the Defense Logistics Agency. Thrust areas include the exploratory development of combat rations, packaging, field food service equipment and combat food service systems, all of which enhance the survivability, sustainability, and supportability of the Armed Forces by ensuring optimal nutritional intake to maximize cognitive and physical performance on the battlefield.

**FY 1996 Accomplishments:**

- 1171 - Evaluated the use of post-coatings for primary and secondary food packaging materials to determine feasibility of increasing use of Commercial-Off-The-Shelf (COTS) items in operational rations; conducted accelerated and long-term storage, sensory and microbiology testing on food products packaged in oxygen absorbent packaging.
  - Developed and tested new preservation technologies for mobility enhancing ration components; conducted field evaluation on performance/utility and acceptability of new nonmetallic primary containers for use in Unitized Group Ration; continued to investigate technologies (e.g., high dose sterilization, pasteurization) which allow the safe incorporation of chilled items (i.e., fresh poultry, fruit, luncheon meats) into operational rations; completed analytical database to assess operational rations for performance-enhancing nutrients.
- 1502 - Completed experimental development of a Nonflammable Ration Heater that costs less and is safer to use than present heaters and transitioned to ration improvement program for engineering development and fielding; completed experimental phase of catalytic reforming of diesel fuel by optimizing process parameters for maximum gas phase hydrocarbon yield; designed and fabricated experimental absorption type heat driven refrigerator and transitioned to technology demonstration; developed and tested low output (1000 BTU/hr) diesel burner for absorption refrigeration system; investigated new food service equipment technologies (e.g., multifunctional, energy efficient, modular equipment) to reduce cost and improve reliability of present and future shipboard galleys; evaluated source reduction equipment to reduce waste backhaul from field kitchens.
- 2525 - Completed selection of constituents and identified acceptable formulation for ration components which ensure enhanced performance under different combat situations; conducted field testing of components to quantify warfighter performance enhancement under varied tactical conditions.
  - Identified and optimized complex carbohydrate components which meet energy requirements during periods of high performance; conducted limited, accelerated technical tests and user studies to evaluate ability to modulate metabolic release over time; identified key process parameters for optimizing innovative thermal processing of rations (i.e., ohmic heating and microwave sterilization) to support the incorporation of "fresh-like" components into operational rations; evaluated emerging microbial issues for safety assessment of temperature abused food to maintain safe/wholesome food supply.

Project AH99

Page 6 of 14 Pages

Exhibit R-2 (PE 0602786A)

260

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602786A Logistics Technology</b>	<b>AH99</b>	
<b>FY 1996 Accomplishments: (continued)</b>			
	<ul style="list-style-type: none"> <li>- Completed laboratory and storage studies for improved high heat, shelf stable ration; transitioned methodology for assessing ration quality of stored rations; completed sensory acceptability studies of novel processed marine products; continued analysis of preservation technologies for destruction of microorganisms in marine products; completed field trials of microbial and chemical test kits to assess sanitation in food processing, assuring ration quality and reducing risk of food borne illness and transitioned to Veterinary Command (VETCOM).</li> </ul>		
Total	5198		
<b>FY 1997 Planned Program:</b>			
	<ul style="list-style-type: none"> <li>• 1625 - Conduct performance tests for continued ration quality on post coated primary and/or secondary food containers of commercially available food items which will improve acceptability; design prototype laminated structure with embedded glass coating for polymeric tray as alternative source to expand production base; conduct storage and sensory tests of ration components packaged in oxygen absorbent materials; identify emerging technologies for interactive packaging and fabricate prototype; continue to investigate irradiation sterilization and pasteurization technologies to improve ration quality and enhance logistics.</li> <li>-Complete optimization and conduct field evaluation of consumer acceptable rations with effective second generation components demonstrating performance enhancement to identify potential components for technology insertion into fielded rations; validate feasibility of intermediate moisture mobility enhancing ration components.</li> <li>• 1488 - Select/incorporate neurotransmitter precursors in ration components or as supplements for improving performance.</li> <li>- Exploit capability to non-invasively measure physiological indices when evaluating nutrients for performance enhancements; continue to identify process parameters for optimizing innovative thermal processing of rations (i.e., ohmic heating) and pursue Food and Drug Administration approval of cutting-edge mechanism to determine sterility; identify/exploit novel hurdle systems to support the incorporation of "fresh-like" and intermediate moisture food components into operational rations.</li> <li>• 1165 - Design and fabricate experimental diesel to gas reformer that can provide a natural-gas-like fuel for commercial gas cooking appliances and transition to technology demonstration; design and fabricate experimental adsorption type thermal fluid driven refrigerator and transition to technology demonstration; integrate low output diesel burner in an absorption refrigeration system and conduct technical feasibility tests; test and evaluate feasibility and functionality of future shipboard galley concept incorporating new food service equipment technologies.</li> <li>• 21 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>		
Total	4299		

Project AH99

Page 7 of 14 Pages

Exhibit R-2 (PE 0602786A)

261

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602786A Logistics Technology	AH99	
FY 1998 Planned Program:			
• 1797	- Investigate cell culture support and monitoring system; determine effects of food components on sleep/wake cycles to enhance combat effectiveness; model the effects of nutrition and hydration on soldier performance.		
• 1336	- Evaluate/develop novel hurdle preservation technologies (water activity reducing components, non-thermal processes), identify suitable recognition compounds and biosensor systems; continue to investigate high dose sterilization to improve quality of military ration components and quantify logistics savings; investigate innovative non-thermal processes for moisture extraction in ration components.		
• 1235	- Incorporate interactive packaging technologies (e.g., oxygen and moisture absorbing) into ration component systems to reduce or eliminate combat ration degradation during storage; fabricate/test high barrier, glass-coated, retortable polymeric tray with easy-open lid for multi-serve, shelf-stable food containers; finalize barrier post coating methodology/application techniques for military use of COTS products and transition to Fielded Group Ration Improvement Program (FGRIP).		
• 4368	- Complete component development of individual warfighter mobility enhancing ration components.		
Total	- Initiate experimental development programs for expeditionary field feeding delivery systems, diesel fired flash bake oven, and individual beverage heater; integrate membrane technology with diesel to gas reformer to provide hydrogen for fuel cell operation.		
FY 1999 Planned Program:			
• 1833	- Continue to investigate/evaluate evolving preservation technologies for ration component; exploit novel ingredients/processes for stabilizing structure and for controlling microbial growth to produce shelf stable, non-retorted components; optimize processing and packaging parameters for shelf-stable vegetables and fruit.		
• 1694	- Continue to determine effects of food components on sleep/wake cycles and downselect the effective nutrients for transitioning to Fielded Individual Ration Improvement Program (FIRIP).		
	- Select/incorporate neurotransmitter precursors in ration components/supplements for anti-stress benefits.		
	- Exploit irradiation sterilization to facilitate the incorporation of "fresh-like" components in military rations.		
	- Evaluate and optimize nutraceutical products for ration supplementation to optimize combat effectiveness.		
	- Optimize processing variables of non-thermal and preconcentration processes on a range of selected ration components to reduce degradative effects, cube, and weight; explore synergistic combinations of new thermal (ohmic and microwave) and non thermal (high pressure and irradiation) to reduce overall processing and produce stable, "just prepared" rations; develop and optimize biosensor probes for quality determination of combat rations by ration inspectors, investigate emerging packaging, ration, and equipment technologies to improve functionality and reduce cost; develop a remote ration quality monitoring system to ensure that the least fresh are shipped first.		
	- Initiate exploratory development program for bioengineering of high energy ration components, incorporation of complex nutri-fuels into rations for improved performance and stress reduction, and protein enhancement of ration components for improved nutritional quality.		

Project AH99

Page 8 of 14 Pages

Exhibit R-2 (PE 0602786A)

Project AH99

Page 8 of 14 Pages

Exhibit R-2 (PE 0602786A)

262

Item 24

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602786A Logistics Technology

PROJECT

AH99

## FY 1999 Planned Program: (continued)

- 1088 - Conduct field evaluations of expeditionary field feeding delivery system for force projection; design and test experimental diesel fired flash bake oven; complete field tests of individual beverage heater and transition to ration improvement program for fielding; produce hydrogen from the diesel to gas reformer and operate a fuel cell.

Total 4615

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

5263

5409

-211

5198

FY 1997

4402

4299

4299

FY 1998

5444

4368

FY 1999

5810

4615

Change Summary Explanation: Funding: FY 1998 - Funding reprogrammed (-1076) for higher priority requirements.

FY 1999 - Funding reprogrammed (-1195) for higher priority requirements.

Project AH99

Page 9 of 14 Pages

Exhibit R-2 (PE 0602786A)

263

Item 24

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602786A Logistics Technology

PROJECT

DJ10

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DJ10 Combat Rations Quality Enhancement	1197	2937	0	0	0	0	0	0	0	4134

**A. Mission Description and Justification:** This project was initiated in FY1992 at the request of Congress to establish a 5 year project to develop technologies for quantifying food quality in combat rations and other emergency feeding situations to enhance consumer acceptance. The project continued in FY 1997 through additional Congressional interest funds. Parameters affecting food quality, including interrelationships among raw materials, processing, packaging, and storage, are determined and analytical techniques for quantification are developed. Innovative processing methods (ohmic heating and combination preservation processes) are investigated. Optimal raw material processing techniques and packaging systems are selected to minimize deteriorative changes in foods and maximize the deliverable quality of subsistence to the user community. The project includes the use of novel electric field and high pressure technologies to pasteurize acidic foods; the efficacy and practicality of non-thermal pasteurization is explored.

**FY 1996 Accomplishments:**

- 1197 - Completed identification and characterization of factors affecting ration quality; identified test methods and models which quantify the quality of combat rations.

Total 1197

**FY 1997 Planned Program:**

- 2865 - Establish good manufacturing practice demonstration sites to facilitate regulatory approval of high pressure and pulsed electric field processing.
- Conduct efficiency and efficacy tests of batch vs. semi-continuous high pressure processes.
- Validate test methods and models which quantify the quality of combat rations.
- 72 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2937

**FY 1998 Planned Program:** Project not funded in FY 98**FY 1999 Planned Program:** Project not funded in FY 99

Project DJ10

Page 10 of 14 Pages

Exhibit R-2 (PE 0602786A)

264

Item 24

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602786A Logistics Technology

DJ10

B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

1228

1263

-66

1197

FY 1997

0

2937

2937

FY 1998

0

0

FY 1999

0

Change Summary Explanation: Funding: FY 1997 - Funding increased by Congress (+2937) to develop technologies for quantifying food quality in combat rations.

Project DJ10

Page 11 of 14 Pages

Exhibit R-2 (PE 0602786A)

265

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602786A Logistics Technology								D283	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D283	Airdrop Advanced Technology	1476	1630	1692	1903	1895	1960	1999	2040	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides exploratory development to enhance personnel and cargo airdrop capabilities. These are key capabilities for force projection, particularly into hostile areas. Areas of emphasis include parachute technology for improved performance, precision offset aerial delivery, soft landing system development, airdrop simulation, and low altitude/high speed airdrop systems technologies. Efforts will result in increased personnel safety and reduced personnel, aircraft, and cargo vulnerability.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>660 - Developed experimental methods for measuring parachute performance to validate parachute opening model and to provide reliable designs for low altitude airdrop systems.</li> <li>- Applied computational fluid dynamics, trajectory analysis, advanced concepts and improved experimental techniques to enhance low altitude parachute performance.</li> <li>- Continued testing and development of the new canopy for low altitude heavy equipment drop.</li> <li>- Analyzed motion of paratroopers during initial parachute deployment to improve personnel airdrop safety.</li> <li>816 - Conducted experimental and theoretical analysis of the opening dynamics and aerodynamics of large gliding wing parafoils to deploy at higher altitudes and greater lateral distances to reduce aircraft vulnerability.</li> <li>- Partially completed virtual analysis of Guided Precision Aerial Delivery Systems (GPADS) precision delivery system, assessing warfighting benefit.</li> <li>- Continued experimentation on soft landing concepts of airbags and parachute retraction.</li> </ul> <p>Total 1476</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>766 - Complete experimental and theoretical analysis of the opening of large deployable gliding wings for use at higher altitudes and greater lateral distances to reduce aircraft vulnerability.</li> <li>- Conduct analysis and experiments on aerodynamics of gliding wings.</li> <li>- Continue full-scale testing of soft landing systems.</li> <li>- Demonstrate satisfactory flight performance of low bulk and light weight new parachutes.</li> <li>- Complete development of experimental methods for measuring parachute performance to validate parachute opening model and to provide reliable designs for high speed low altitude airdrop systems.</li> <li>854 - Develop 3-D computer model to analyze inflation of round canopy parachutes and ram-air gliding wings to minimize full-scale airdrop testing.</li> <li>- Continue motion analysis of paratroopers during initial parachute deployment to improve personnel airdrop safety.</li> </ul>											

Project D283

Page 12 of 14 Pages

Exhibit R-2 (PE 0602786A)

266

Item 24

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602786A Logistics Technology

PROJECT

D283

## FY 1997 Planned Program: (continued)

- Using the results of computational fluid dynamics and trajectory analyses, determine characteristics/factors that will enhance low altitude parachute performance.
- Identify parameters for developing a model of human performance/biomechanics to improve parachutist's safety.
- Analyze parachute collapse phenomenon to increase airdrop safety.
- Complete virtual analysis of GPADS, assessing its warfighting benefits.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

• 10  
Total 1630

## FY 1998 Planned Program:

- 849 - Modify new low bulk and light weight parachutes to improve flight performance.
- Conduct analysis and experiments on aerodynamics of gliding wings.
- Demonstrate parachute retraction concept using clustered parachutes for soft landing of airdropped payloads.
- Implement cold-gas injection and controlled venting to airbags for soft landing of airdropped payloads.
- 843 - Complete motion analysis of paratroopers during initial parachute deployment to improve personnel airdrop safety.
- Continue analysis of parachute collapse phenomenon.
- Continue 3-D computer model development to analyze inflation of round canopy parachutes and ram-air gliding wings to minimize full-scale air drop testing.

Total 1692

## FY 1999 Planned Program:

- 1058 - Apply 3-D computer model to analyze parachute performance and to minimize full-scale airdrop testing.
- Complete motion analysis of cargo platforms.
- Complete analysis of parachute collapse phenomenon to improve personnel airdrop safety.
- Implement parachute and airdrop systems performance models to virtual battlefield simulation.
- 845 - Conduct full-scale test of airbags equipped with cold-gas injection and controlled venting for soft landing of air dropped payloads.
- Apply new parachute concepts to large cargo parachutes.
- Investigate new design and construction concepts for parafoils to minimize costs.

Total 1903

Project D283

Page 13 of 14 Pages

Exhibit R-2 (PE 0602786A)

267

Item 24

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>2 - Applied Research</b>	<b>0602786A Logistics Technology</b>	<b>D283</b>	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	1492	1665	1906
Adjustments to Appropriated Value	1546	1630	2151
FY 1998 Pres Bud Request	-70		
	1476	1630	1692
			1903
<p>Change Summary Explanation: Funding: FY 1998 - Funding reprogrammed (-214) to higher priority requirements.  FY 1999 - Funding reprogrammed (-248) to higher priority requirements.</p>			

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

## 0602787A Medical Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	70575	104332	74684	75307	72307	74149	74801	76014	Continuing	Continuing
A825 Combat Maxillofacial Injury	1003	504	0	0	0	0	0	0	0	1507
A838 Neurotoxin Exposure Treatment	0	24477	0	0	0	0	0	0	0	24477
A839 Computer-Assisted Signaling Cancer Cell Proliferation	0	2252	0	0	0	0	0	0	0	2252
A841 Computer-Assisted Minimally Invasive Surgery	0	2448	0	0	0	0	0	0	0	2448
A842 ENT Minimally Invasive Simulation	0	979	0	0	0	0	0	0	0	979
A843 Health Tech Roadmaps	0	3427	0	0	0	0	0	0	0	3427
A845 Bone Disease Research Program	0	9791	0	0	0	0	0	0	0	9791
A863 Battlefield Surgical Replacement	0	1958	0	0	0	0	0	0	0	1958
A870 DoD Medical Defense Against Infectious Diseases	25009	28799	28520	25753	24448	25420	26020	26634	Continuing	Continuing
A872 Neurofibromatosis Research	8000	0	0	0	0	0	0	0	0	8000
D873 HIV Exploratory Research	2731	2869	21791	20576	19035	19056	18512	18411	Continuing	Continuing
A874 Combat Casualty Care Technology	11680	11176	8822	10159	9896	10087	10295	10530	Continuing	Continuing
A878 Health Hazards of Military Materiel	6808	7141	8012	9629	9934	10272	10466	10719	Continuing	Continuing
A879 Medical Factors Enhancing Soldier Effectiveness	9769	8511	7539	9190	8994	9314	9508	9720	Continuing	Continuing
A898 Wound Healing	1897	0	0	0	0	0	0	0	0	1897

Page 1 of 25 Pages

Exhibit R-2 (PE 0602787A)

269

Item 25

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE
BUDGET ACTIVITY										February 1997
PE NUMBER AND TITLE										
2 - Applied Research										
0602787A Medical Technology										
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A899 Emergency Medical Teams	3678	0	0	0	0	0	0	0	0	3678

**Mission Description and Budget Item Justification:** This program element (PE) funds exploratory development in Department of Defense (DoD) medical protection against naturally occurring diseases of military importance and combat dentistry, as well as exploratory development for Department of Army care of combat casualties, health hazard assessment of military materiel, and medical factors enhancing soldier effectiveness. The primary goal of medical research and development is to sustain medical technology superiority to improve the protection and survivability of U.S. forces on conventional battlefields as well as in potential areas of low intensity conflict and military operations short of war. This program element is the core DoD technology base to develop methods and materials for: infectious disease prevention and treatment including vaccines, prophylactic and therapeutic drugs, insect repellents, and methods of diagnosis and identification of naturally occurring infectious diseases; prevention and treatment of combat maxillofacial (face and neck) injuries, and essential dental treatment on the battlefield; combat casualty care of trauma and burns due to weapons, organ system survival, shock resulting from blood loss and infection, blood preservation and potential blood substitutes for battlefield care; assessment of the health hazards of military materiel, and the sustainment or enhancement of soldier performance. The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan, Army force modernization plans, and Project Reliance. This program is managed primarily by the US Army Medical Research and Materiel Command. Efforts in this PE include non-system specific development efforts pointed toward specific military needs and are appropriate to Budget Activity 2.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602787A Medical Technology

PROJECT

A825

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A825 Combat Maxillofacial Injury	1003	504	0	0	0	0	0	0	0	1507

**A. Mission Description and Justification:** This project has as its major thrusts exploratory development of new/improved methods and materiel for rapid simplified treatment of face and neck wounds and provision of field dental treatment.

**FY 1996 Accomplishments:**

- 506 Conducted clinical study comparing oral motor function of fracture patients treated by surgical means with those treated by non-surgical means.
- 43 Evaluated efficacy of sustained-action and receptor-selective analgesics in animal models.
- 454 Prepared hyper-speed parallel video camera for incorporation into robotic surgical assistant test bed.
- Total 1003

**FY 1997 Planned Program:**

- 48 Evaluate toxicity of novel analgesics.
- 443 Begin design of hyper-speed parallel computer interface to hyper-speed parallel camera for robotic surgical assistant test bed.
- 13 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 504

**FY 1998 Planned Program:** Tasks and funding restructured to PE 0602787A, Project 874.

**FY 1999 Planned Program:** Tasks and funding restructured to PE 0602787A, Project 874.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	1029	514	535	564
Appropriated Value	1058	504		
Adjustments to Appropriated Value	-55			
FY 1998 Pres Bud Request	1003	504	0	0

**Change Summary Explanation:**

Funding: FY 1998: Tasks and funding (-535) restructured to PE 0602787A Project A874  
FY 1999: Tasks and funding (-564) restructured to PE 0602787A Project A874

Project A825

Page 3 of 25 Pages

Exhibit R-2 (PE 0602787A)

271

Item 25

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
2 - Applied Research		0602787A Medical Technology								A838																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
A838	Neurotoxin Exposure Treatment	0	24477	0	0	0	0	0	0	0	24477																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for neurotoxin exposure treatment.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>23879 Evaluated competitive contracts/grants to initiate research on neurotoxin exposure treatment.</li> <li>598 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 24477</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>24477</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>24477</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+24477) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	24477			FY 1998 Pres Bud Request	0	24477	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	24477																													
FY 1998 Pres Bud Request	0	24477	0	0																											

Project A838

Page 4 of 25 Pages

Exhibit R-2 (PE 0602787A)

272

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602787A Medical Technology

PROJECT

A839

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A839 Computer-Assisted Signaling Cancer Cell Proliferation	0	2252	0	0	0	0	0	0	0	2252

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for computer-assisted signaling cancer cell proliferation.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 2197 Evaluated competitive contracts/grants to initiate research on computer assisted signaling cancer cell proliferation.
- 55 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2252

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99

**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
0	0	0	0
0	2252		
0	2252	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+2252) provided by Congressional action.

Project A839

Page 5 of 25 Pages

Exhibit R-2 (PE 0602787A)

273~

Item 25

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
2 - Applied Research		0602787A Medical Technology								A841																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
A841	Computer-Assisted Minimally Invasive Surgery	0	2448	0	0	0	0	0	0	0	2448																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for computer-assisted minimally invasive surgery.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2389 Evaluated competitive contracts/grants to initiate research on computer-assisted minimally invasive surgery.</li> <li>59 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 2448</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>2448</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>2448</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+2448) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	2448			FY 1998 Pres Bud Request	0	2448	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	2448																													
FY 1998 Pres Bud Request	0	2448	0	0																											

Project A841

Page 6 of 25 Pages

Exhibit R-2 (PE 0602787A)

274

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602787A Medical Technology

PROJECT

A842

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A842 ENT Minimally Invasive Simulation	0	979	0	0	0	0	0	0	0	979

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for ENT. minimally invasive simulation.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 955 Evaluated competitive contracts/grants to initiate research on ENT. minimally invasive simulation.
- 24 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 979

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
0	0	0	0
0	979		
0	979	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+979) provided by Congressional action.

Project A842

Page 7 of 25 Pages

Exhibit R-2 (PE 0602787A)

275

Item 25

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
2 - Applied Research		0602787A Medical Technology								A843																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
A843	Health Tech Roadmaps	0	3427	0	0	0	0	0	0	0	3427																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for health tech roadmaps.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3343 Evaluated competitive contracts/grants to initiate research on health tech roadmaps.</li> <li>• 84 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 3427</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>3427</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>3427</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+3427) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	3427			FY 1998 Pres Bud Request	0	3427	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	3427																													
FY 1998 Pres Bud Request	0	3427	0	0																											

Project A843

Page 8 of 25 Pages

Exhibit R-2 (PE 0602787A)

276

Item 25

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0602787A Medical Technology

PROJECT

## 2 - Applied Research

A845

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A845 Bone Disease Research Program	0	9791	0	0	0	0	0	0	0	9791

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for bone disease research program.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 9552 Evaluated competitive contracts/grants to initiate research on bone disease research program.
  - 239 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 9791

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	0	0	0
Appropriated Value	0	9791		
Adjustments to Appropriated Value				
FY 1998 Pres Bud Request	0	9791	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+9791) provided by Congressional action.

Project A845

Page 9 of 25 Pages

Exhibit R-2 (PE 0602787A)

277

Item 25

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
2 - Applied Research		0602787A Medical Technology								A863																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
A863	Battlefield Surgical Replacement	0	1958	0	0	0	0	0	0	0	1958																				
<p><b>A. Mission Description and Justification:</b> This research is directed towards development of equipment and bio-material for use in repairing trauma and burn injuries in the field.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1910 Development of equipment and bio material to repair trauma and burn injuries in the field.</li> <li>• 48 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 1958</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>1958</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>1958</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+1958) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	1958			FY 1998 Pres Bud Request	0	1958	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	1958																													
FY 1998 Pres Bud Request	0	1958	0	0																											

Project A863

Page 10 of 25 Pages

Exhibit R-2 (PE 0602787A)

278

Item 25

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602787A Medical Technology

PROJECT

A870

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A870 DoD Medical Defense Against Infectious Diseases		25009	28799	28520	25753	24448	25420	26020	26634	Continuing	Continuing

**A. Mission Description and Justification:** This project supports development of medical countermeasures to naturally occurring infectious disease, a significant threat to forces deployed outside the United States. These countermeasures will protect the force from infection and sustain operations by preventing hospitalizations and evacuations from the theater of operations.

## FY 1996 Accomplishments:

- 10846 Prepared malaria vaccines and tested them in animals; prepared and evaluated prophylactic/therapeutic drugs to address resistant parasites; evaluated insecticide barrier and repellent methods of protection from insect vectors. Transitioned to Milestone 0 one antimalarial vaccine, one *antileishmanial* drug and one *Leishmania* skin test.
- 6197 Constructed and evaluated candidate vaccines against *shigella*, *Enterotoxigenic Escherichia coli*, and *Campylobacter* using novel methodology. Transitioned to Milestone 0 one antishigella vaccine, and one antiscrub typhus drug.
- 7246 Prepared and evaluated killed and recombinant vaccine candidates for *dengue*; evaluated deployable diagnostic tests.
- 720 Evaluated antibiotic resistance in clinical scrub typhus isolates.
- Total 25009

## FY 1997 Planned Program:

- 2766 Conduct an analysis of the adjuvant systems used with RTS,S and begin a two year study to determine the immunological basis for immunity induced by irradiated sporozoites.
- 1801 Conduct epitope mapping to identify protective antigens of *Shigella*, microencapsulate mutant labile toxin, and determine the range of cross serotype protection in *Campylobacter*.
- 1308 Perform absorption, distribution, metabolism, and excretion studies of candidate antiparasitic drugs to satisfy FDA requirements.
- 1469 Use genetic engineering technology to isolate, clone, and produce *dengue* fever antigens. Determine which nucleic acid sequences are the most promising for incorporation into a DNA vaccine to prevent *dengue* fever.
- 1352 Optimize a wet antigen capture assay for rapid detection of drug resistant malaria, and compare reagents for a new skin test for excreted factor of *Leishmania*. Investigate technologies and establish databases that will lead to the development of a computerized vector identification key.
- 616 Incorporate purified meningococcal outer membrane proteins and lipopolysaccharides into liposomes to improve the parental meningitis vaccine. Optimize the hand held assay for scrub typhus.

Project A870

Page 11 of 25 Pages

Exhibit R-2 (PE 0602787A)

279

Item 25

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
2 - Applied Research	0602787A Medical Technology	A870	
FY 1997 Planned Program: (continued)			
• 1506	Produce candidate reagents for the immunotherapy of hemorrhagic viruses. Construct a prototype multigene hepatitis E DNA vaccine for testing in animals.		
• 12651	Enhance capabilities in production and delivery methods for vaccines including liposome and microencapsulation technology, and begin the two year program to construct and test the forward deployable malaria diagnostic device. Pay administrative overhead costs at the WRAIR.		
• 5171	Pay transition costs of moving the WRAIR into a new facility.		
• 159	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total	28799		
FY 1998 Planned Program:			
• 2931	Complete the analysis of the adjuvant systems used with RTS,S and the two year study to determine the immunological basis for immunity induced by irradiated sporozoites.		
• 1894	Begin the construction of <i>Shigella dysenteriae</i> vaccine candidates, produce and purify recombinant <i>E. coli</i> antigens, and construct a live-attenuated <i>Campylobacter</i> vaccine candidate.		
• 922	Begin the validation process of a new method for structure-based drug design. Prepare candidate drugs for <i>in vivo</i> testing.		
• 1329	Construct a tetraivalent killed whole virus <i>dengue</i> vaccine candidate. Select nucleic acid sequences of interest.		
• 1296	Optimize a quantitative dry dipstick assay for rapid detection of drug resistant malaria, and begin the optimization of the ELISA diagnostic device for <i>Leishmania</i> infections. Under laboratory conditions, test the most promising compounds to replace DEET insect repellent.		
• 387	Improve the mucosal meningitis vaccine by using native outer membrane vesicles without removal of the lipopolysaccharides. Begin the two year program to identify antibiotic resistance genes for scrub typhus.		
• 1342	Optimize the polyvalent vaccine candidate to prevent <i>Hantavirus</i> infections. Evaluate the simultaneous immunization of personnel against hepatitis viruses.		
• 12639	Enhance capabilities in production and delivery methods for vaccines including conjugation technology, and complete testing of a forward deployable malaria diagnostic device. Pay administrative overhead costs at the Walter Reed Army Institute of Research (WRAIR).		
• 5780	Pay transition costs of moving the WRAIR into a new facility.		
Total	28520		
FY 1999 Planned Program:			
• 3210	Begin investigations on how to best combine vaccine candidates for both <i>P. falciparum</i> and <i>P. vivax</i> into one vaccine.		
• 2231	Begin studies on how best to construct a trivalent <i>Shigella</i> vaccine, optimize formulations that include both <i>E. coli</i> antigens and mucosal adjuvants in the same microsphere, develop animal models to investigate a possible link between Guillain-Barre syndrome and <i>Campylobacter</i> infections.		
• 1010	Complete <i>in vitro</i> testing of a new drug to treat multi drug-resistant malaria (artelnic acid) and a new drug to prevent multi drug-resistant malaria (acridine analog).		
Project A870		Page 12 of 25 Pages	
		Exhibit R-2 (PE 0602787A)	

Project A870

Page 12 of 25 Pages

Exhibit R-2 (PE 0602787A)

280

Item 25

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602787A Medical Technology

PROJECT

A870

## FY 1999 Planned Program: (continued)

- 1457 Construct a tetraivalent multigene nucleic acid *dengue* vaccine candidate and a tetraivalent recombinant *dengue* vaccine candidate.
  - 1566 Complete the optimization of the ELISA diagnostic device for *Leishmania* infections. Compare products, delivery equipment, and methodologies for arthropod vector control, including barrier spraying, to determine the most effective approach.
  - 709 Improve animal models for the testing of meningitis vaccines. Complete the studies to identify antibiotic resistant genes for scrub typhus.
  - 1694 Optimize vaccines to prevent Crimean-Congo hemorrhagic fever and Lassa fever. Evaluate the simultaneous immunization of personnel against hepatitis A, B and E.
  - 13026 Study ways to optimize yield of vaccine components during scaleup, and test a forward deployable diagnostic device for *dengue*, *shigella*, and *hantavirus*. Pay administrative overhead costs at the Walter Reed Army Institute of Research (WRAIR).
  - 850 Pay transition costs of moving the WRAIR into a new facility.
- Total 25753

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	25190	24643	25752	26749
Appropriated Value	25889	28799		
Adjustments to Appropriated Value	-880			
FY 1998 Pres Bud Request	25009	28799	28520	25753

## Change Summary Explanation:

Funding: FY 1997: Funds (+4156) provided by Congress for transition costs for occupancy of the newly constructed WRAIR.  
 FY 1998: Funds reprogrammed (+2768) into this project for transition costs for occupancy of the newly constructed WRAIR.

Project A870

Page 13 of 25 Pages

Exhibit R-2 (PE 0602787A)

281

Item 25

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602787A Medical Technology								A872	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A872	Neurofibromatosis Research	8000	0	0	0	0	0	0	0	0	8000
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for neurofibromatosis.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>8000 Began the process to award competitive contracts/grants to initiate research on neurofibromatosis.</li> </ul> <p>Total 8000</p> <p><b>FY 1997 Planned Program:</b> Program not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <p>FY 1997 President's Budget 0</p> <p>Appropriated Value 0</p> <p>Adjustments to Appropriated Value 0</p> <p>FY 1998 Pres Bud Request 8000</p> <p>Change Summary Explanation: Funding: FY 1996: Funding (+8000) transferred from the Defense Health Program by Congressional direction.</p>											

Project A872

Page 14 of 25 Pages

Exhibit R-2 (PE 0602787A)

282

Item 25

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 2 - Applied Research

PE NUMBER AND TITLE

0602787A Medical Technology

PROJECT

D873

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D873 HIV Exploratory Research		2731	2869	21791	20576	19035	19056	18512	18411	Continuing	Continuing

**A. Mission Description and Justification:** This project provides for exploratory development of improved diagnostics, epidemiology, candidate immunogens, promising drugs and behavioral modification for prevention and treatment of HIV. Main efforts include developing experimental models of disease, preparation of new vaccine candidates, improved diagnosis of disease and risk assessment. Current policy prohibits antibody positive service members from OCONUS deployment. A safe and effective vaccine for prevention of infection and intervention techniques will permit all service members to become worldwide deployable.

**FY 1996 Accomplishments:**

- 934 Evaluated the effectiveness of candidate HIV vaccines.
- 240 Established a significant protective effect (>50%) of HIV-2 infection for subsequent HIV-1 infection in humans.
- 832 Defined viral and immunogenic markers that distinguish rapid and slow rates of HIV disease progression.
- 725 Conducted cohort feasibility studies in various locations in Thailand.
- Total 2731

**FY 1997 Planned Program:**

- 463 Conduct vaccination/challenge studies of HIV candidate vaccines and bacterial and viral delivery systems in animal models to determine the effect of vaccine formulation and regimen.
- 463 Determine correlates of immunity and identify less virulent strains of HIV to assist in vaccine construction.
- 463 Evaluate live attenuated HIV-1 for clinical development potential.
- 1410 Improve vaccine candidate diversification to increase coverage of global variants.
- 70 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 2869

**FY 1998 Planned Program:**

- 4691 Conduct animal model and other preclinical studies of candidate vaccines (including complex protein, subunit, recombinant, DNA, and inactivated whole virus candidates) to prevent infection with HIV. Conduct Phase 1 vaccine trials in Thailand.
- 3100 Develop and maintain international and domestic laboratories to support efficacy trials. Includes quality control and standardization of laboratory assays.
- 3400 Prepare for efficacy testing by conducting cohort development including identifying high incidence groups and coordinating the efforts of regulatory agencies and scientific collaborators as they relate to populations at risk.

Project D873

Page 15 of 25 Pages

Exhibit R-2 (PE 0602787A)

283

Item 25

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602787A Medical Technology

PROJECT

D873

## FY 1998 Planned Program: (continued)

- 3100 Conduct national and international surveillance of HIV genotypes, conduct threat analysis of HIV stains, and characterize HIV specific epitopes to construct candidate vaccines for national and international use.
- 2100 Conduct studies of the natural history of HIV disease to determine vaccine trial endpoints. Expand the natural history data base and maintain a repository of sera samples.
- 2200 Improve vaccine candidates by investigating molecular conformation of protein antigens, role of specific cell receptors and viral correlates in infectivity and pathogenicity.
- 2000 Conduct studies on the clinical management of HIV by immune reconstitution.
- 1200 Conduct studies on HIV antiviral drugs, resistance evaluation, and rapid diagnosis of HIV infection.
- Total 21791

## FY 1999 Planned Program:

- 4391 Evaluate animal model and other preclinical studies of candidate vaccines (including complex protein, subunit, recombinant, DNA, and inactivated whole virus candidates) to prevent infection with HIV. Conduct additional Phase 1 trials in Thailand.
- 3100 Continue to upgrade and support international and domestic laboratories to support efficacy trials. Ensure quality control and standardization of laboratory assays.
- 3200 Prepare for Phase 3 trials by conducting cohort development including identifying high incidence groups and coordinating the efforts of regulatory agencies and scientific collaborators as they related to populations at risk.
- 3100 Conduct national and international surveillance of HIV genotypes, conduct threat analysis of HIV stains, and characterize HIV specific epitopes to construct candidate vaccines for national and international use.
- 2100 Conduct studies of the natural history of HIV disease to determine vaccine trial endpoints. Expand the natural history data base and maintain a repository of sera samples.
- 2100 Improve vaccine candidates by investigating molecular conformation of protein antigens, role of specific cell receptors and viral correlates in infectivity and pathogenicity.
- 1800 Complete and evaluate initial studies on the clinical management of HIV by immune reconstitution.
- 785 Conduct studies on HIV antiviral drugs, resistance evaluation, and rapid diagnosis of HIV infection. Continue to monitor the appearance of drug resistance and prepare to implement rapid diagnosis of HIV infection.
- Total 20576

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2801	2931	3054	3235
2879	2869		
-148			
2731	2869	21791	20576

Project D873

Page 16 of 25 Pages

Exhibit R-2 (PE 0602787A)

284

Item 25

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE <b>0602787A Medical Technology</b>	PROJECT <b>D873</b>
<p>Change Summary Explanation:</p> <p>Funding: FY98: Funding increased (+18300) to provide increased emphasis on research into HIV/AIDS. FY99: Funding increased (+16900) to provide increased emphasis on research into HIV/AIDS.</p>		
Project D873		Exhibit R-2 (PE 0602787A)

Page 17 of 25 Pages

285

Item 25

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602787A Medical Technology								A874	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A874	Combat Casualty Care Technology	11680	11176	8822	10159	9896	10087	10295	10530	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project funds the core technology base to develop concepts, techniques and material for the treatment and return-to-duty of soldiers wounded in combat and to support Low Intensity Combat as well as military operations other than war. This project addresses investigation of the treatments for weapons-induced trauma and burns, and shock due to blood loss. It also funds technologies for resuscitation fluid and blood preservation.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>1195 Conducted production of purified and chemically modified hemoglobins and characterized their physiological effects in animal models.</li> <li>820 Determined the efficacy and safety of red cells stored for eight weeks in standard refrigeration; prepared for transition to advanced development; identified optimal fibrin sealant formulations for hemorrhage control; explored methods for lyophilized storage of platelets.</li> <li>3613 Defined requirements for oxygen administration to hemorrhaging individuals in an animal model; characterized physiological effects of moderate hypothermia and heat shock protein induction as protective measures against hemorrhagic shock and organ failure.</li> <li>795 Demonstrated <i>in vivo</i> neuroprotective efficacy of lead candidate dextromethorphan and carbetapentane analogs in rodent models to justify advanced clinical development.</li> <li>405 Determined the efficacy of immune therapy (antibodies to lipopolysaccharide) in the treatment of septic shock, using appropriate animal models.</li> <li>463 Conducted prototype resuscitation pump and bench testing; evaluated feasibility of servo-controlled resuscitation in large animal models.</li> <li>4389 Explored clinical efficacy and safety of countermeasures to burn and inhalation injury, including skin grafting materials, synthetic pulmonary surfactants, and antimicrobial agents.</li> </ul> <p>Total 11680</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>183 Identify best approaches for increasing the life span of whole blood in refrigerated storage.</li> <li>1635 Evaluate methods of hypothermia induction for protection against shock; determine effects of hibernation vs. hypothermia on cell metabolism and analyze risks vs. benefits; explore pharmacological inducers of heat shock proteins.</li> <li>1391 Characterize biochemical and pharmacological mechanisms of traumatic brain injury and define effects of potential countermeasures; define <i>in vivo</i> neuroprotective efficacy of lead candidate dextromethorphan and carbetapentane analogs in large animal models to justify advanced clinical development.</li> <li>1481 Conduct evaluations of candidate cartilage repair techniques, to correct battle or training injuries to joints.</li> <li>229 Evaluate efficacy of microencapsulated anesthetic and analgesic compounds in animal models.</li> </ul>											

Project A874

Page 18 of 25 Pages

Exhibit R-2 (PE 0602787A)

286

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602787A Medical Technology

A874

## FY 1997 Planned Program: (continued)

- 1156 Develop interfaces and controllers to link medical sensors to monitoring systems (Soldier Individual Computer or other dedicated system).
- 1056 Evaluate use of silver-nylon fabric as an antimicrobial wound dressing.
- 3846 Evaluate non-invasive sensor, Life Support for Trauma and Transport (LSTAT), Advanced Surgical Suite for Trauma Casualties (ASSTC) digital surgical facility and other advance technology prototypes.
- 199 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 11176

## FY 1998 Planned Program:

- 1493 Verify early versus delayed fluid resuscitation therapy following massive hemorrhage associated with penetrating trauma.
- 1455 Evaluate serine protease inhibitors as a candidate drug for prevention of ischemia/reperfusion injury in brain and spinal cord.
- 1182 Evaluate effectiveness of silver-coated pins for far forward fracture fixation and stabilization.
- 1408 Determine feasibility of Laser Burn Debridement in models of military relevant burns or other appropriate wounds.
- 2346 Continue evaluating and refining sensors, surgical and evacuation technology, including LSTAT and ASSTC (listed above).
- 938 Begin evaluation of miniature version of LSTAT = miniSTAT as far forward intensive care and diagnostic support platform.
- Total 8822

## FY 1999 Planned Program:

- 3182 Evaluate various phospholipase A2 inhibitors and serine protease inhibitors for prevention of ischemia/reperfusion injury in brain, spinal cord, and other organs.
- 3987 Evaluate various oxygen free radical scavengers for their ability to mitigate ischemia/reperfusion injury in central nervous and other soft tissues.
- 2990 Evaluate use of Laser Burn Debridement in military relevant burns or other appropriate wounds.
- Total 10159

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	11916	11415	10444	10607
Appropriated Value	12249	11176		
Adjustments to Appropriated Value	-569			
FY 1998 Pres Bud Request	11680	11176	9401	10192

Change Summary Explanation: Funding: FY 1998: Funds reprogrammed (-1043) to higher priority programs.

Project A874

Page 19 of 25 Pages

Exhibit R-2 (PE 0602787A)

287

Item 25

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
2 - Applied Research		0602787A Medical Technology								A878	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A878	Health Hazards of Military Materiel	6808	7141	8012	9629	9934	10272	10466	10719	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project focuses on protecting soldiers from health hazards associated with their own materiel and operational environments. Emphasis is on identification of health hazards inherent to the engineering design and operational use of equipment, systems and materiel used in Army combat operations and training. Specific hazards include: steady-state acoustical energy, repeated impact jolt and vibration stress from operation of combat vehicles and aircraft; blast over pressure and impulse noise generated by firing weapons systems; toxic chemical hazards associated with Army materiel such as gun and rocket munitions and their combustion byproducts; non-ionizing radiation directed energy sources (laser and microwave); and environmental stressors (e.g., heat, cold, terrestrial altitude). Specific medical research tasks include characterizing the extent of exposure to potential hazards; delineating exposure thresholds for illness or injury; identifying exposure thresholds for performance degradation; establishing biomedical databases to support protection criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>721 Determined guidelines to minimize eye-strain with extended use of vision enhancement devices.</li> <li>1206 Published field guide to prevent environmental injury in hot, wet, tropical environments.</li> <li>1400 Developed safe exposure criteria for frequency agile lasers.</li> <li>1230 Characterized health risks from combustion products of new artillery system.</li> <li>2251 Determined validated tolerance limits for shoulder-fired anti-armor weapons fired from enclosures.</li> </ul> <p>Total 6808</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>878 Develop blast overpressure injury model for generic blast health hazards assessments.</li> <li>146 Demonstrate effectiveness of individual soldier medical monitoring system in preventing heat and cold injury.</li> <li>1707 Characterize the health hazards of electromagnetic pulse from prototype electro-magnetic weapon systems.</li> <li>1498 Characterize effects of likely concurrent exposure to multiple chemicals from Army systems.</li> <li>2737 Demonstrate efficacy of early-phase anti-inflammatory therapy for treatment of laser eye injury.</li> <li>Complete dose response curve model for mechanical jolt and repeated impacts.</li> <li>175 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 7141</p>											

Project A878

Page 20 of 25 Pages

Exhibit R-2 (PE 0602787A)

288

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 2 - Applied Research

0602787A Medical Technology

PROJECT

A878

## FY 1998 Planned Program:

- 2355 Establish performance-based models characterizing levels of visual impairment pertinent to battlefield laser injury.
- 1551 Field effective means to optimize aircrew endurance during sustained rotary-winged flight operations without aircrew performance decrements.
- 2817 Develop biofidelic models for head and neck response to biodynamic forces.
- 1289 Develop near-real time toxic hazard assessments of non-agent chemical exposures.
- Total 8012

## FY 1999 Planned Program:

- 2723 Develop and test field therapy kits for laser retinal therapy.
- 1832 Investigate the effects of three dimensional audio on improving aviators' communications performance.
- 3161 Field improved human tolerance criteria for head impact protection in air and ground combat vehicles.
- 1913 Develop near-real time toxic hazard assessments of non-agent chemical exposures.
- Total 9629

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	6984	7294	7745	8227
Appropriated Value	7181	7141		
Adjustments to Appropriated Value	-197			
FY 1998 Pres Bud Request	6808	7141	8012	9629

## Change Summary Explanation:

Funding: FY 1999: Funds reprogrammed (+1402) into this project to fund the remainder of the U.S. Army Biomedical Research and Development Laboratory that was restored in BRAC 95.

Project A878

Page 21 of 25 Pages

Exhibit R-2 (PE 0602787A)

289

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE										DATE	PROJECT
2 - Applied Research		0602787A Medical Technology										February 1997	A879
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost		
A879	Medical Factors Enhancing Soldier Effectiveness	9769	8511	7539	9190	8994	9314	9508	9720	Continuing	Continuing		

**A. Mission Description and Justification:** This project focuses on sustaining warfighting capability by preventing health and performance degradation in the military environment. Emphasis is on identification of health hazards inherent to the engineering design and operational use of equipment, systems and materiel used in Army combat operations and training. Specific hazards included: steady-state acoustical energy, repeated impact jolt and vibration stress from operation of combat vehicles and aircraft; blast overpressure and impulse noise generated by firing weapons systems; toxic chemical hazards associated with Army materiel such as gun and rocket munitions and their combustion byproducts; non-ionizing radiation directed energy sources (laser and microwave); and environmental stressors (e.g. heat, cold, terrestrial altitude). Specific medical research tasks include characterizing performance decrements produced by environmental stressors; developing strategies to overcome these decrements, including training, nutrition, and pharmacological solutions; delineating exposure thresholds for illness or injury; identifying exposure thresholds for performance degradation; establishing biomedical databases to support sustainment criteria; and developing and validating models for hazard assessment, injury prediction, and health and performance protection.

**FY 1996 Accomplishments:**

- 2500 Conducted preliminary tests with Norwegian ranger students to evaluate physiological norms for noninvasive sensor telemetry.
- 1562 Identified biomedical and mission factors affecting work and performance at high terrestrial altitudes.
- 3707 Demonstrated behavioral and materiel means to reduce musculoskeletal injuries during military operations.
- 2000 Developed new visual assessment and selection test to assess capabilities and visual loss in aviators.
- Total 9769

**FY 1997 Planned Program:**

- 4857 Develop new safety tables for immersion exposure based on modeling data from U.S. Army Ranger students.
- 2440 Demonstrate behavioral and pharmacological strategies to enhance thermoregulation in hot and cold environments.
- 1147 Develop recommendations for a single set of body fat standards for the services which enhance and do not impair readiness.
- 67 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 8511

**FY 1998 Planned Program:**

- 2548 Determine the regional brain effects of alertness enhancing and sleep-inducing medications using brain imaging techniques.
- 931 Determine critical factors relating Army family support and soldier mental health and performance during long-term deployments.

Project A879

Page 22 of 25 Pages

Exhibit R-2 (PE 0602787A)

290

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 2 - Applied Research

0602787A Medical Technology

A879

## FY 1998 Planned Program: (continued)

- 2316 Integrate real-time satellite-derived weather data into thermal strain decision aids for battlefield commanders.
- 1744 Develop training strategies and countermeasures to prevent stress fractures.
- Total 7539

## FY 1999 Planned Program:

- 3103 Validate a new continuous operations simulation designed to demonstrate and refine the sleep-induction/rapid re-awakening and stimulant components of the Sleep Management System.
- 3174 Test field-ready combined biochemical, physiological and psychometric stress diagnostics for potential far-forward use in real-time assessment to identify severely stressed soldiers at risk for combat stress reaction.
- 1000 Develop strategies for the Air and Land Warrior programs to modify skin blood flow to maximize the effectiveness of microclimate cooling/heating.
- 1913 Develop countermeasures to performance decrements from spatial disorientation during night vision assisted flight.
- Total 9190

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	9901	8693	9245	9682
Appropriated Value	10177	8511		
Adjustments to Appropriated Value	-408			
FY 1998 Pres Bud Request	9769	8511	7539	9190

Change Summary Explanation: Funding: FY 1998: Funds reprogrammed (-1706) to higher priority programs.

Project A879

Page 23 of 25 Pages

Exhibit R-2 (PE 0602787A)

291

Item 25

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
2 - Applied Research		0602787A Medical Technology								A898																										
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
A898	Wound Healing	1897	0	0	0	0	0	0	0	0	1897																									
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for advanced methods of promoting wound healing.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1897 Evaluated competitive contracts/grants to initiate research on wound healing.</li> </ul> <p>Total 1897</p> <p><b>FY 1997 Planned Program:</b> Program not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>1946</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-103</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td></td> <td>1897</td> <td></td> <td></td> <td></td> </tr> </table>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	1946	0	0	0	Adjustments to Appropriated Value	2000				FY 1998 Pres Bud Request	-103	0	0	0		1897			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	1946	0	0	0																																
Adjustments to Appropriated Value	2000																																			
FY 1998 Pres Bud Request	-103	0	0	0																																
	1897																																			

Project A898

Page 24 of 25 Pages

Exhibit R-2 (PE 0602787A)

292

Item 25

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
A899

## 2 - Applied Research

## 0602787A Medical Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A899 Emergency Medical Teams	3678	0	0	0	0	0	0	0	0	3678

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for emergency medical teams.

## FY 1996 Accomplishments:

- 3678 Awarded competitive contracts/grants to initiate research on emergency medical teams.

Total 3678

FY 1997 Planned Program: Program not funded in FY 97.

FY 1998 Planned Program: Program not funded in FY 98.

FY 1999 Planned Program: Program not funded in FY 99.

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
3772	0	0	0
3878			
-200			
3678	0	0	0

Project A899

Page 25 of 25 Pages

Exhibit R-2 (PE 0602787A)

293

Item 25

UNCLASSIFIED



## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

2 - Applied Research

0602789A Army Artificial Intelligence Technology

PROJECT

A880

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A880 Army Artificial Intelligence Technology	2054	2179	855	1330	1320	1399	1439	1484	Continuing	Continuing

**A. Mission Description and Budget Item Justification:** The goal of the Artificial Intelligence (AI) exploratory development program is to mature AI technology for future insertion into Army applications to achieve the strategic advantage needed to perform the Army's world-wide missions. The threefold purpose of the program is to: (1) develop/apply AI technology to solve large scale, highly complex management problems; (2) investigate AI technology for use Army-wide (policy, personnel training and management, and applications development); and (3) transfer technology to the Army through exploratory development efforts. In addition, the program seeks to identify high potential, but embryonic AI methodologies and mature them for high payoff applications through targeted technology demonstration projects and the development of working models. This program has established a number of sophisticated AI cells (knowledge engineering groups (KEGs)) focusing on the integration and application of AI technologies to problems in functional communities such as command and control, management, force integration, logistics, modeling, intelligence, resource management, test and evaluation, training, and medical. Focus for this science and technology effort is assisted through these functionally oriented cells. In addition, an office of AI research, analysis and evaluation has been established at the United States Military Academy to conduct AI applications research and development. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Force XXI. This project includes non-system specific development efforts pointed toward specific military needs and therefore is appropriate to Budget Activity 2. This program is overseen by the U.S. Army AI Program General Officer Steering Committee (GOSC) and is managed primarily by the US Army AI Center, Pentagon.

**FY 1996 Accomplishments:**

- 2054 - Demonstrated use of AI technology in integrating vastly different data and technologies to solve highly complex problems.
- Demonstrated effectiveness of hybrid systems within manufacturing and robotics domains.
- Investigated integration of hybrid systems within synthetic environments for command and control AI systems.
- Demonstrated the integration of hybrid systems for the testing and evaluation of AI systems.

Total 2054

**FY 1997 Planned Program:**

- 2126 - Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems.
- Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains.
- Investigate integration of hybrid systems within synthetic environments for command and control AI systems.
- Demonstrate the integration of hybrid systems for the testing and evaluation of AI systems.
- Investigate the application of Intelligent Agent Technology in AI systems supporting Force XXI.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

53  
Total 2179

Project A880

Page 1 of 2 Pages

Exhibit R-2 (PE 0602789A)

294

Item 26

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT																									
BUDGET ACTIVITY	PE NUMBER AND TITLE																											
<b>2 - Applied Research</b>	<b>0602789A Army Artificial Intelligence Technology</b>	<b>February 1997</b>	<b>A880</b>																									
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 855 - Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems.</li> <li>- Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains.</li> <li>- Demonstrate the effectiveness of Intelligent Agents in enhancing human performance.</li> <li>- Investigate AI based prognostics technology for logistics and maintenance.</li> </ul> <p>Total 855</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1330 - Demonstrate use of AI technology in integrating vastly different data and technologies to solve highly complex problems.</li> <li>- Demonstrate effectiveness of hybrid systems within manufacturing and robotics domains.</li> <li>- Investigate integration of hybrid systems within synthetic environments for command and control AI systems.</li> <li>- Demonstrate the integration of hybrid systems for the testing and evaluation of AI systems.</li> <li>- Demonstrate the effectiveness of AI based prognostics systems in achieving "just-in-time" supply and maintenance.</li> </ul> <p>Total 1330</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>2107</td> <td>2226</td> <td>2645</td> <td>3317</td> </tr> <tr> <td>Appropriated Value</td> <td>2166</td> <td>2179</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-112</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>2054</td> <td>2179</td> <td>855</td> <td>1330</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1998 funds reprogrammed (-1790) to higher priority requirements. FY 1999 funds reprogrammed (-1987) to higher priority requirements.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	2107	2226	2645	3317	Appropriated Value	2166	2179			Adjustments to Appropriated Value	-112				FY 1998 Pres Bud Request	2054	2179	855	1330
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	2107	2226	2645	3317																								
Appropriated Value	2166	2179																										
Adjustments to Appropriated Value	-112																											
FY 1998 Pres Bud Request	2054	2179	855	1330																								

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603001A Logistics Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	38820	22724	35469	32197	32122	14544	16134	14676	Continuing	Continuing
DC07 Joint Service Food Technology Demonstration	1846	1851	1940	1987	2027	2066	2106	2152	Continuing	Continuing
DC44 Tactical Logistics	755	0	0	0	0	0	0	0	0	755
DJ28 Test Measurement Technology Development	0	246	0	0	0	0	0	0	0	246
DJ50 Force XXI Land Warrior	30548	15936	11298	7016	6423	6434	7669	7997	Continuing	Continuing
D242 Airdrop Equipment	1240	1223	1258	1273	1919	3216	3522	3672	Continuing	Continuing
D393 Military Operations in Urban Terrain	0	0	20255	21124	20942	2002	1997	0	0	66320
D543 Ammunition Logistics	3155	3032	718	797	811	826	840	855	Continuing	Continuing
D544 Cooperative Explosive Safety	950	0	0	0	0	0	0	0	0	950
D594 Metrology and Calibration	326	436	0	0	0	0	0	0	0	762

**Mission Description and Budget Item Justification:** This program supports demonstration of technology for the dismounted soldier and materiel essential to support and sustain wartime operations and peacetime readiness, both strategically and tactically. Its purpose is to develop, demonstrate, and transfer affordable technologies to enhance dismounted soldier system performance and capabilities, reduce the logistics burden on the battlefield, reduce operation and support (O&S) costs, and improve ammunition logistics system performance. It includes diverse projects linked by broad applications benefiting whole categories of weapons systems and providing high return on investment. The Joint Service Food Technology project demonstrates food service systems and food products, processing, preservation, and serving equipment resulting from technology programs jointly approved by the Services and the Defense Logistics Agency that will improve field feeding efficiencies, ration quality, and warfighter combat effectiveness. The Tactical Logistics project demonstrated applications of technology for tactical electric power. Force XXI Land Warrior develops and demonstrates advanced technology components for insertion into the Land Warrior program and performs the integration of future soldier system technologies focused on improving soldier performance, lethality and survivability. Enhancements to airdrop equipment for rapid deployment are required for dropping cargo from higher altitudes, greater offset distances and at higher speed, increasing survivability of aircraft and crews and increasing the probability that materials delivered will land in a usable condition. The Military Operations in Urban Terrain (MOUT) ACTD will identify, integrate, and demonstrate a system of existing and emerging technologies to provide

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**RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)**

DATE

**February 1997**

BUDGET ACTIVITY

**3 - Advanced Technology Development**

PE NUMBER AND TITLE

**0603001A Logistics Advanced Technology**

improved Command, Control, Communications, and Intelligence (C4I), engagement, and force protection for Soldiers and Marines operating in the restrictive urban environment.

The Ammunition Logistics project demonstrates technology that optimizes weapon system rearm, ammunition packaging/palletization, explosives safety, material handling equipment, ammunition throughput/management for improved asset availability and survivability. Contractors performing the work for this PE include Motorola, Hughes, Honeywell, Gentex, Battelle, Arthur D. Little, Tecogen, Pioneer Aerospace, Giordano Automation, and InterVision. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. This program adheres to Tri-Service Reliance Agreements on clothing, textiles and food and explosive ordnance disposal with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with efforts in PE 0602786A (Logistics Technology), Navy's integrated diagnostic support system, Missile Command Infrared (IR) scene generation, Defense Advanced Research Project Agency (DARPA) millimeter/microwave integrated circuit (MMIC), Small Unit Operations projects, and the Joint Services Calibration Coordination Committee. The Ammunition Logistics project is related to PE 0602624A (Weapons and Munitions Technology) and PE 0603004A (Weapons and Munitions Advanced Development). These efforts contain no unwarranted duplication of effort among the Military Departments. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603001A Logistics Advanced Technology

PROJECT

DC07

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DC07 Joint Service Food Technology Demonstration	1846	1851	1940	1987	2027	2066	2106	2152	Continuing	Continuing

**A. Mission Description and Justification:** Joint Service Food is a DoD program, for which the Army has executive agent responsibility, which demonstrates nutritionally advanced rations and logistically streamlined food delivery systems to sustain DoD personnel in all operations and to enhance their combat performance under diverse battlefield scenarios. The project focuses on demonstrations of advances in food technology, materials, energy utilization, and combination heating technologies to provide extended, simplified field feeding without resupply. It exploits advances in ration formulation and quality, packaging, preservation, and nutritional content to improve morale, extend endurance, and sharpen mental acuity. This project is managed by the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.

**FY 1996 Accomplishments:**

- 624 - Demonstrated promising technologies (including aseptic processing, horizontal form/fill/seal and high barrier polymeric tray) for potential technology insertion to expand combat ration variety, improve acceptability, nutrient retention, producibility and reduce costs.
- Demonstrated, under realistic field conditions, prototype high heat stable ration components; demonstrated the impact of nutrient content modifications and/or supplements to rations in hot weather feeding scenarios (43% increase in carbohydrate intake and 22% decrease in fat consumed).
- Initiated a demonstration of the eat-on-the-move characteristics of Mobility Enhancing Ration improvements which exploit advances in food processing technologies and in ration packaging.
- 1222 - Conducted technical demonstrations of a centrally heated thermal fluid heat transfer system in a small mobile kitchen validating rapid deployability, 70% efficiency, high reliability, ease of operation, multi-ration flexibility, and the ability to produce more meals faster and cheaper than conventional systems; transitioned to advanced development; designed and fabricated Thermal-Powered Washer for demonstration of improved field sanitation capability.

Total 1846

**FY 1997 Planned Program:**

- 982 - Conduct demonstration of the Mobility Enhancing Ration Components, which incorporate advances in packaging technologies (i.e., horizontal form/fill/seal), increasing the operational capabilities of warfighters.
- Demonstrate improved rations/consumption which will result in a 15-20 percent increase in nutrient bioavailability of calcium and iron in high temperature environments and transition to Defense Logistics Agency (DLA).
- Conduct demonstrations of selected performance enhancing nutrients and food components (i.e. carbohydrate beverages, caffeine, tyrosine).
- Obtain Services' approval of selected Performance Enhancing Ration Components (PERCs) and transition to DLA.
- Demonstrate producibility and microbial safety of a shelf stable/fresh-like ration based on multiple barrier processing of marine products to expand the variety of ration meals.

Project DC07

Page 3 of 18 Pages

Exhibit R-2 (PE 0603001A)

298

Item 27

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603001A Logistics Advanced Technology

PROJECT

DC07

## FY 1997 Planned Program: (continued)

- 823 - Demonstrate a Thermal-Powered Washer in the Food Sanitation Center that reduces water and fuel consumption by 50%, while providing more effective sanitation; design and fabricate an adsorption type heat driven refrigerator for technical demonstrations in mobile field kitchens to enhance A-Ration capability.

- 46 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1851

## FY 1998 Planned Program:

- 983 - Complete technology demonstration of Mobility Enhancing Ration Components and transition to DLA; conduct technology demonstration of multi barrier processing of marine ration components and transition to DLA; conduct technology demonstration of Performance Enhancing Ration Components and transition to Fielded Individual Ration Improvement Program (FIRIP).

- Develop algorithm to model effects of performance-enhancing nutrients on warfighter mission performance.

- 957 - Demonstrate an adsorption type heat driven refrigerator that will keep food cold for one to three days, and that can be regenerated with a standard field burner; transition to advanced development; design and fabricate a diesel to gas reformer that can provide a natural-gas-like fuel for commercial gas cooking appliances for technical demonstrations in mobile field kitchens; complete test and evaluation of future shipboard galley concept incorporating new food service equipment technologies.

Total 1940

## FY 1999 Planned Program:

- 1987 - Complete demonstration of a field feeding system based on recent advances in catalytic diesel combustion, thermal fluid heat transfer, integral power generation and regenerative refrigeration that is highly mobile (HMWWV towable), rapidly deployable (minutes), more efficient (50% decrease in fuel), more reliable (50% increase in mean-time between failure (MTBF)), and that expands the tactical situations (by 40%) in which hot meals can be prepared and delivered.

- Demonstrate producibility of interactive packaging technologies and quantify the effects of interactive packaging on improving ration acceptance and consumption; transition to DLA.

- Demonstrate the effects of incremental differences in carbohydrates on mission effectiveness and completion.

Total 1987

B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

1893

1946

-100

1846

FY 1997

1891

1851

1851

FY 1998

1895

1940

FY 1999

2003

1987

Project DC07

Page 4 of 18 Pages

Exhibit R-2 (PE 0603001A)

299

Item 27

UNCLASSIFIED



RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
3 - Advanced Technology Development		0603001A Logistics Advanced Technology								DC44																										
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
DC44	Tactical Logistics	755	0	0	0	0	0	0	0	0	755																									
<p><b>A. Mission Description and Justification:</b> This project developed technology and materials to improve tactical electrical power availability for all DoD systems. Efforts were directed toward drastically decreasing the size, weight, and number of engines, generators and auxiliary power units needed to power the battlefield. Programs specifically supported include Soldier Individual Power, the Joint Project Office for Unmanned Aerial Vehicles, and Special Operations Forces programs. This project was managed by the U.S. Army Communications-Electronics Command, Ft. Monmouth, NJ.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>755 - Completed power requirements analysis for dismounted soldier systems. Conducted and completed battery study to meet dismounted soldier system requirements.</li> </ul> <p>Total 755</p> <p><b>FY 1997 Planned Program:</b> Project not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>775</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>796</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-41</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td></td> <td>755</td> <td></td> <td></td> <td></td> </tr> </table>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	775	0	0	0	Adjustments to Appropriated Value	796	0			FY 1998 Pres Bud Request	-41	0	0	0		755			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	775	0	0	0																																
Adjustments to Appropriated Value	796	0																																		
FY 1998 Pres Bud Request	-41	0	0	0																																
	755																																			

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
3 - Advanced Technology Development		0603001A Logistics Advanced Technology								DJ28																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
DJ28	Test Measurement Technology Development	0	246	0	0	0	0	0	0	0	246																				
<p><b>A. Mission Description Justification:</b> This program develops diagnostics and prognostics technology to allow weapon systems to anticipate failure or, when failure occurs, self diagnose by means of embedded diagnostics. Embedded diagnostics make possible multicapable maintainers, allowing a reduction in the number of Military Occupational Specialties (MOS) and training times; it also supports the concept of "fix forward" for the purpose of reducing the levels of maintenance. Older systems will be maintained by a wearable, hands-free, intelligent maintenance aid now under development. This project is managed by the U.S. Army Test, Measurement, and Diagnostic Equipment Activity, Redstone Arsenal, AL.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 240 - Enhance Apache prototype electronics manuals with maintenance and repair support system (MARSS) wearable maintenance aid and advanced diagnostics.</li> <li>• 6 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).</li> </ul> <p>Total 246</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>251</td> <td>400</td> <td>576</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>246</td> <td></td> <td></td> </tr> <tr> <td>FY1998 Pres Bud Request</td> <td>0</td> <td>246</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1998/1999 - Funds reprogrammed to higher priority requirements.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	251	400	576	Adjustments to Appropriated Value	0	246			FY1998 Pres Bud Request	0	246	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	251	400	576																											
Adjustments to Appropriated Value	0	246																													
FY1998 Pres Bud Request	0	246	0	0																											

Project DJ28

Page 6 of 18 Pages

Exhibit R-2 (PE 0603001A)

301

Item 27

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE										DATE	PROJECT
3 - Advanced Technology Development		0603001A Logistics Advanced Technology										February 1997	DJ50
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost		
DJ50	Force XXI Land Warrior	30548	15936	11298	7016	6423	6434	7669	7997	Continuing	Continuing		
<p><b>A. Mission Description and Justification:</b> This project was created as the result of FY 1996 Congressional direction to consolidate the Generation II Soldier and the Land Warrior (LW) Programs and addresses the critical Army need to enhance the performance, lethality, survivability, and sustainment of the individual soldier. This project is the Land Warrior science and technology (S&amp;T) program. The Force XXI Land Warrior efforts will focus on technology insertions to the LW backbone and perform risk reduction tasks aimed at providing to the LW program appropriate technologies which will enhance the LW system or provide improved capabilities such as Reduced Weight Helmet, Helmet Mounted Display, Digital Radio, Voice Activated Soldier Radio and Radio Packet Relay. An early user test (EUT) will be performed during late FY 1998 and early FY99 with modified LW systems to assess the performance of the science and technology (S&amp;T) components. These results will be utilized to further reduce LW fielding risks and to ensure that future LW procurements are upgraded with current technological advancements. Another Force XXI Land Warrior component which will form a part of this effort is Integrated Sight which involves a lighter uncooled IR rifle sight with integrated target handover functions. Other emerging technology base components will also be considered as candidates for technology insertion onto the LW platform through these efforts. These components include combat identification, personnel status monitor, future infantry weapons, mine detection, chemical agent detector, and others. This program will leverage the commercial microelectronics and telecommunications industries to achieve lightweight, miniaturized components. The U.S. Marine Corps is an active participant in this program. In FY 1996, a significant portion of the total program funding was used to perform work within Budget Activity 5 (Engineering and Manufacturing Development (EMD)) in accordance with the FY 1996 Appropriations language which consolidated the funding for both S&amp;T and non-S&amp;T into a single project. In FY 1997, the EMD work was separated into the appropriate Budget Activity within PE 0604713A (Night Vision Systems - EMD). This project is managed by the U.S. Army Soldier Systems Command, Natick, MA.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 10473 - Completed Phase II (bread board components) of the Generation II Soldier ATD. <ul style="list-style-type: none"> <li>- Initiated risk reduction designs/virtual prototyping (e.g. helmet to reduce weight) and began development of advanced components (e.g. radio packet relay and integrated sight) in support of the Land Warrior Program.</li> <li>- Completed technology insertion plans for Land Warrior upgrades.</li> </ul> </li> <li>• 20075 - Initiated LW EMD program and established Integrated Product Teams. <ul style="list-style-type: none"> <li>- Completed LW EMD preliminary design review (PDR) and critical design review (CDR) for early operational experimentation (EOE) systems and software design review (SDR) for pre-production qualification test (PPQT) systems.</li> <li>- Performed iterative development along with User feedback, to reduce risk while developing a system that meets User's requirement for EOE.</li> <li>- Procured prototype components of integrated helmet with speakers and day/night displays, digital radio, laser rangefinder digital compass, and image intensifier for squad size early operational experimentation (EOE).</li> <li>- Performed LW EMD program management: scheduling, program controls, program documentation, and review of performance, cost and schedule; reviewed LW EMD contractor's performance, to include system analysis, and logistics support.</li> </ul> </li> </ul>													
Total		30548											

Project DJ50

Page 7 of 18 Pages

Exhibit R-2 (PE 0603001A)

302

Item 27

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603001A Logistics Advanced Technology

PROJECT

DJ50

## FY 1997 Planned Program:

- 15547 - Complete risk reduction designs/virtual prototyping in support of Land Warrior.
- Develop and fabricate advanced technology components for insertion into Land Warrior Systems in preparation for the early user test.
- Procure long lead items for additional Land Warrior systems to be used in evaluating advanced technology components.
- Identify and initiate development of component enhancements based on the results of Early Operational Experimentation.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

389

15936

Total

## FY 1998 Planned Program:

- 5050 - Continue development of the Integrated Sight; deliver 9 short range and 3 long range sights.
- Continue development of evolutionary technology insertion components for the Land Warrior.
- Continue development of revolutionary technology insertion components for the Land Warrior system.
- 6248 - Procure Land Warrior pre-production qualification test (PPQT) systems.
- Integrate evolutionary components into Land Warrior PPQT systems.
- Perform baseline early user test with PPQT systems.
- Perform early user test with upgraded PPQT systems.

11298

Total

## FY 1999 Planned Program:

- 5500 - Continue development of revolutionary technology insertions for the Land Warrior.
- Complete early user testing of upgraded PPQT systems.
- Perform a cost and operational effectiveness analysis on evolutionary components.
- Prepare transition documents for transitioning of evolutionary components to the Land Warrior system.
- Integrate revolutionary components into upgraded PPQT systems.
- 1516 - Develop Military Operations in Urban Terrain (MOUT) technology insertion components.
- Integrate MOUT capabilities into upgraded PPQT systems.

1516

7016

Total

Project DJ50

Page 8 of 18 Pages

Exhibit R-2 (PE 0603001A)

303

Item 27

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
<b>3 - Advanced Technology Development</b>	<b>0603001A Logistics Advanced Technology</b>		<b>DJ50</b>
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	29181	16277	6324
Adjustments to Appropriated Value	30000	15936	2410
FY1998 Pres Bud Request	+548		
	30548	15936	11298
			7016
Change Summary Explanation: Funding: FY 1998/1999 - Funds increased to perform EUT with greater number of technologies and to enable the transition of the insertions to LW.			

Project DJ50

Page 9 of 18 Pages

Exhibit R-2 (PE 0603001A)

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE										DATE	PROJECT
3 - Advanced Technology Development		0603001A Logistics Advanced Technology										February 1997	D242
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost		
D242	Airdrop Equipment	1240	1223	1258	1273	1919	3216	3522	3672	Continuing	Continuing		
<p><b>A. Mission Description and Justification:</b> This project focuses on the demonstration and development of innovative techniques and equipment for aerial delivery of cargo, a key capability for rapid force projection, particularly into hostile areas. The goal is precision delivery of heavier payloads from extremely high altitude (up to 25,000 ft) and offset distance. Delivery from high altitudes and offset distance improves cargo/personnel and aircraft survivability. A major effort in FY 1997 is the initiation of the design and fabrication of an advanced airdrop system which will lead to the demonstration of revolutionary technologies for the reliable precision guided delivery of combat essential munitions/sensors and equipment using high glide wing technology and incorporating a low cost, modular global positioning system (GPS) guidance package and control system.</p>													
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>1240 - Continued testing of 15,000 pound capacity prototype parafoil system autonomous GPS guidance, navigation and control (GN&amp;C) and soft landing capability (GPADS - Medium).</li> <li>- Conducted Advanced Technology Demonstration (ATD) of complete 15,000 lb. capacity parafoil system.</li> <li>- Defined concepts for High Glide Air Delivery (HGAD) system with 5000 lb. payload capacity (goal of 10,000 lbs.) and 6:1 glide ratio.</li> </ul>													
Total		1240											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1193 - Design and begin fabrication of High Glide Air Delivery system prototype using high glide wing technology.</li> <li>- Integrate guidance, navigation and control system with high glide wing technology.</li> <li>30 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul>													
Total			1223										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1258 - Complete fabrication of High Glide Air Delivery prototypes.</li> <li>- Conduct extraction test from USAF aircraft.</li> </ul>													
Total				1258									
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1273 - Conduct flight testing of High Glide Air Delivery system.</li> <li>- Conduct demonstration of High Glide Air Delivery System.</li> </ul>													
Total					1273								
Project D242													

Exhibit R-2 (PE 0603001A)

Page 10 of 18 Pages

305

Item 27

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development		D242	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	1272	1249	1247
Adjustments to Appropriated Value	1307	1223	1260
FY1998 Pres Bud Request	-67		
	1240	1223	1258
			1273

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603001A Logistics Advanced Technology								D393	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D393	Military Operations in Urban Terrain	0	0	20255	21124	20942	2002	1997	0	0	66320
<p><b>A. Mission Description and Justification:</b> This project conducts the integration of a system of systems and conducts a series of live demonstrations and simulations to identify technology and assess operational solutions for enhancing military operations in urban terrain. In FY 1998, the Military Operations in Urban Terrain (MOUT) Advanced Concept Technology Demonstration (ACTD) will be initiated by integrating the products of promising technology developments underway in the Army, Marine Corps, DARPA, creating the MOUT System of Systems. The objective is to improve the command, control, communications, computers, and intelligence (C4I), survivability, and engagement capabilities of the soldiers and Marines, and ensure the effective interoperability of these capabilities in the particularly challenging urban environment. The program vision is to set the stage for the rapid and efficient acquisition and fielding of value-added components in the MOUT System of Systems following the completion of the ACTD. A company set of residuals for an interim leave-behind capability will be procured during FY 1998/1999; the full spectrum residuals will be procured FY 2000. Follow-on support to the receiving operational unit will be conducted during FY 2001/2002. The MOUT ACTD is a joint ACTD between the Army and the Marine Corps, with participation from DARPA. This project is managed by U.S. Army Natick Research, Development, and Engineering Center, Natick, MA.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b> Project not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 11031 - Award engineering services contract to conduct the integration/interoperability assessments/diagnoses of Army/USMC/DARPA technology products.</li> <li>• 9224 - Conduct simulations and exercise models to assess/quantify military value-added of MOUT components.</li> <li>- Procure prototype/residual hardware/software for use in MOUT experiments.</li> <li>- Conduct initial MOUT demonstrations/experiments at Fort Benning and Camp Lejeune.</li> <li>- Conduct planning/management/coordination/execution of MOUT ACTD program.</li> </ul> <p>Total 20255</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 9864 - Conduct engineering services for the integration/interoperability assessments/diagnoses of Army/USMC/DARPA technology products in MOUT.</li> <li>- Continue to conduct simulations and exercise models to assess/quantify military value-added of MOUT components; assess MOUT Training, Tactics and Procedures (TTPs).</li> </ul>											

Project D393

Page 12 of 18 Pages

Exhibit R-2 (PE 0603001A)

307

Item 27

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE			
<b>3 - Advanced Technology Development</b>	<b>0603001A Logistics Advanced Technology</b>	<b>D393</b>		
<b>FY 1999 Planned Program: (continued)</b>				
<ul style="list-style-type: none"> <li>11260 - Continue to procure prototype/residual hardware/software for use in MOUT experiments.</li> <li>- Conduct follow-on MOUT demonstrations/experiments at Fort Benning and Camp Lejeune.</li> <li>- Continue to conduct planning/management/coordination/execution of MOUT ACTD program.</li> </ul>				
Total	21124			
<b>B. Project Change Summary</b>				
FY 1997 President's Budget		FY 1996	FY 1997	FY 1998
Appropriated Value		0	0	20311
Adjustments to Appropriated Value				
FY1998 Pres Bud Request		0	0	20255
				21124

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced Technology Development

0603001A Logistics Advanced Technology

PROJECT

D543

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	D543 Ammunition Logistics	3155	3032	718	797	811	826	840	855	Continuing

**A. Mission Description and Justification:** This project develops technology that maximizes munitions availability and survivability for the force projection Army. It enhances logistics survivability and force readiness through improvements in explosive safety, materiel handling equipment, ammunition and missile packaging/palletization, and asset throughput/management. It also improves weapon system rearm for artillery, armor, air defense, aviation, and infantry. Emerging technologies and productivity enhancers/cost savers are exploited to provide quantum improvements to the force projection (strategic), in-theater (operational), and combat-focused (tactical) logistics systems. This project is managed by the U.S. Army Armament Research, Development, and Engineering Center, Picatinny Arsenal, NJ. Efforts will transition to weapons and munitions technology/development programs and the Total Army Distribution System.

**FY 1996 Accomplishments:**

- 1848 - Demonstrated advanced munitions packaging technologies in the following areas: advanced materials, adhesives and bonding, vibration damping, cushioning, and "smart" sensors that monitor and record environmental data (temperature, humidity, pressure, shock, corrosion) throughout the logistics cycle.
- Demonstrated a fire extinguishing system for ammunition plants/depots that utilizes advanced fire detection sensor and suppression technology to reduce system response time by 75%.
- 1307 - Upgraded FASTLOAD (artillery rearm module on HEMMT) with digital interface to allow external transfer of inventory and requirements data.
- Completed demonstration of prototype insensitive munitions (IM) packaging and transitioned to item developers.
- Developed concepts/investigated modeling and simulation in support of the Munitions Survivability program.

Total 3155

**FY 1997 Planned Program:**

- 1914 - Demonstrate prototype handling equipment enhancements for improved munitions velocity management.
- Develop prototype decision aid software to help soldiers design survivable forward area ammunition storage sites.
- Complete design concepts of barriers, shields, and packaging to prevent explosive incompatibilities and maximize the survivability of munitions strategic configured loads.
- 1051 - Select and initiate testing of lightweight, fire retardant and shock absorbing material candidates for a rapid ammunition protection system to limit loss at a forward ammunition storage area to only 1% of assets from a direct hit and also reduce ammunition storage area footprint by 60%.
- Develop heat transport computer codes and hydrocode sympathetic detonation models for treating shocks, rapid compression, and penetration in porous rapid ammo protection system material candidates.
- Complete upgrade and conduct demonstration of FASTLOAD automated rearm system for towed and self-propelled howitzers.

Project D543

Page 14 of 18 Pages

Exhibit R-2 (PE 0603001A)

309

Item 27

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603001A Logistics Advanced Technology</b>	<b>D543</b>	
<b>FY 1997 Planned Program: (continued)</b>			
• 67 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.			
Total	3032		
<b>FY 1998 Planned Program:</b>			
• 718 - Calibrate sympathetic detonation computational models to define specifications for a rapid ammunition protection system which prevents fire propagation and achieves optimum shock attenuating performance.			
Total	718		
<b>FY 1999 Planned Program:</b>			
• 797 - Conduct full scale experiments to verify sympathetic detonation computational models to demonstrate a rapid ammo protection system utilizing lightweight, high performance materials and designs optimized to prevent fire propagation and mitigate explosive propagation.			
Total	797		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget		FY 1996	FY 1997
Appropriated Value		3228	3097
Adjustments to Appropriated Value		3318	3032
FY1998 Pres Bud Request		-163	
		3155	3032
			718
			797
Change Summary Explanation: Funding: FY 1998/1999 - Funds reprogrammed to higher priority requirements.			

Project D543

Page 15 of 18 Pages

Exhibit R-2 (PE 0603001A)

310

Item 27

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603001A Logistics Advanced Technology

PROJECT

D544

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D544 Cooperative Explosive Safety	950	0	0	0	0	0	0	0	0	950

**A. Mission Description and Justification:** This was a cooperative program with the Republic of Korea (ROK). Efforts were devoted to improving ammunition explosives safety through technology solutions. The effort focused on the development, testing, and validation of new underground explosives storage techniques to reduce explosives storage hazards with no reduction in security, operational readiness, or logistical support. Results of the effort are anticipated to produce approved underground storage designs and revised US explosives safety criteria and have the impact of increasing ammunition storage safety throughout the Department of Defense (DoD) ammunition storage complex. This program concluded in December 1996 as specified in the Joint U.S./ROK Memorandum of Agreement. No FY 1997 funds were programmed or required to complete the program. This project was managed by the U.S. Army Technical Center for Explosives Safety, Savanna, IL.

**FY 1996 Accomplishments:**

- 950 - Conducted validation test and evaluated test data.
- Integrated test data and logistics considerations into operational full-scale underground facility concept.
- Developed and completed technical designs and data packages of full-scale facilities for underground ammunition storage.

Total 950

**FY 1997 Planned Program:** Project not funded in FY 97.**FY 1998 Planned Program:** Project not funded in FY 98.**FY 1999 Planned Program:** Project not funded in FY 99.**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
969	0	0	0
995	0		
-45			
950	0	0	0

Project D544

Page 16 of 18 Pages

Exhibit R-2 (PE 0603001A)

311

Item 27

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603001A Logistics Advanced Technology								D594	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D594	Metrology and Calibration	326	436	0	0	0	0	0	0	0	762

**A. Mission Description and Justification:** This project provides Army weapon systems and technology developers with cost effective, time saving, legally mandated, traceable calibration equipment for microwave, electro-optics, mechanical, and electronic systems. This is a Joint Logistics Commanders program, closely coordinated with the Navy and Air Force, which directly supports Army research, development, and engineering centers (RDECs), test ranges, and proving grounds. Among the weapons systems directly supported are Search and Destroy Armor (SADARM), Longbow, Military Strategy Tactical and Relay Satellite System (MILSTAR), Integrated Family of Test Equipment (IFTE), and High Power Coherent Radar (HPCOR). The Intrinsic Standards Voltage Calibrator that stems from this project is an advance of international significance, and was reported at the National Conference of Standards Laboratory Conference in 1994. The United States National Institute for Standards and Technology (NIST) directly participated in this calibrator program and benefited from technology transfer, as has the United States cryogenics industry. The calibrator has improved the Army's calibration program, and the U.S. Navy, Air Force, and NASA are expected to apply this technology to their programs. This project is managed by the U.S. Army Test Measurement and Diagnostic Equipment Activity, Redstone Arsenal, AL.

**FY 1996 Accomplishments:**

- 326 - Completed technology development for Fourier Transform Infrared non-linearity effects.
- Began development of intrinsic voltage for alternating current Josephson Junction effect.
- Field-tested closed-cycle refrigerated Josephson Junction intrinsic voltage standard.

Total 326

**FY 1997 Planned Program:**

- 425 - Develop wireless access of weapon system test data for remote analysis.
- Develop prototype lightweight glasses for displaying test data.
- 11 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 436

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99.

Project D594

Page 17 of 18 Pages

Exhibit R-2 (PE 0603001A)

312

Item 27

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603001A Logistics Advanced Technology	D594	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	336	445	564
Adjustments to Appropriated Value	345	436	
FY 1998 Pres Bud Request	-19		
	326	436	0
Change Summary Explanation: Funding: FY 1998/1999 - Funds reprogrammed to higher priority requirements.			

Project D594

Page 18 of 18 Pages

Exhibit R-2 (PE 0603001A)

Item 27

313

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)						DATE	February 1997				
BUDGET ACTIVITY		PE NUMBER AND TITLE									
3 - Advanced Technology Development		0603002A Medical Advanced Technology									
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	90591	201198	10677	10959	10691	10826	11986	12543	Continuing	Continuing
D804	Prostate Cancer Research	0	44058	0	0	0	0	0	0	0	44058
D806	Breast Cancer Research	71119	97906	0	0	0	0	0	0	0	169025
D810	Industrial Base/Infectious Disease Vaccines and Drugs	8888	9034	8274	8504	8018	8129	8674	9096	Continuing	Continuing
D813	Trichloromelamine Testing	0	490	0	0	0	0	0	0	0	490
D814	Neurofibromatosis	0	7832	0	0	0	0	0	0	0	7832
D815	National Medical Testbed	0	5874	0	0	0	0	0	0	0	5874
D816	Computer-Based Decision Support System	0	5874	0	0	0	0	0	0	0	5874
D817	Computer-Aided Diagnostic Research	0	2937	0	0	0	0	0	0	0	2937
D818	Advanced Cancer Detection Center	0	3427	0	0	0	0	0	0	0	3427
D819	Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	1683	2350	0	0	207	202	581	602	Continuing	Continuing
D840	Combat Injury Management	2264	2324	2403	2455	2466	2495	2731	2845	Continuing	Continuing
D887	Ovarian Cancer Research	0	7343	0	0	0	0	0	0	0	7343
D892	Blood Analyzer	1897	0	0	0	0	0	0	0	0	1897
D893	Tissue Replacement	4740	11749	0	0	0	0	0	0	0	16489

Page 1 of 20 Pages

Exhibit R-2 (PE 0603002A)

Page 1 of 20 Pages

Exhibit R-2 (PE 0603002A)

314

Item 28

UNCLASSIFIED

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>		DATE <b>February 1997</b>
BUDGET ACTIVITY	PE NUMBER AND TITLE	
<b>3 - Advanced Technology Development</b>	<b>0603002A Medical Advanced Technology</b>	
<p><b>Mission Description and Budget Item Justification:</b> This program element funds advanced technology development for the DoD core Vaccine and Drug Program, field medical protective devices and combat injury management. These latter two projects focus on diagnostic imaging devices, clinical studies of combat casualty care treatment modalities, and nutrition and soldier performance enhancement. The DoD core Vaccine and Drug Program provides, in accordance with Food and Drug Administration (FDA) regulations, drugs and vaccines for development which are effective protectants, treatments, and antidotes against military disease threats. Pilot and standard lots of candidate pharmaceutical-grade drugs, antidotes and vaccines are produced. The primary goal of this program is to provide, with minimum adverse effects, maximum soldier survivability and sustainability on the integrated battlefield as well as in military operations other than war. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is managed primarily by the US Army Medical Research and Materiel Command. This program is dedicated to conducting proof of principle field demonstrations and tests of non-system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.</p>		

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
3 - Advanced Technology Development		0603002A Medical Advanced Technology								D804																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
D804	Prostate Cancer Research	0	44058	0	0	0	0	0	0	0	44058																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for prostate cancer research to include studying prostate cancer diagnosis and treatment in cooperation with the Center for Prostate Disease Research.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>42981 Evaluate and award competitive contracts/grants to initiate research on prostate cancer.</li> <li>1077 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 44058</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>44058</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>44058</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+44058) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	44058			FY 1998 Pres Bud Request	0	44058	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	44058																													
FY 1998 Pres Bud Request	0	44058	0	0																											

Project D804

Page 3 of 20 Pages

Exhibit R-2 (PE 0603002A)

316

Item 28

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE							DATE	PROJECT																										
3 - Advanced Technology Development		0603002A Medical Advanced Technology							February 1997	D806																										
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
D806	Breast Cancer Research	71119	97906	0	0	0	0	0	0	0	169025																									
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to continue the peer-reviewed Breast Cancer Research Program, specifically for improvements within the military health care system, for in-house DoD training, education, access to care, and improved detection technology programs dedicated to serving service members and their families.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>71119 Evaluated 445 grants/contracts deemed scientifically and programmatically relevant in accordance with the 1993 Institute of Medicine Report. Conducted scientific peer review of 2511 proposals. Completed negotiations and awarded 292 grants and contracts for the FY 1995 program</li> </ul> <p>Total 71119</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>95514 Conduct programmatic review and negotiate awards of grants and contracts for the FY 1996 program. Evaluate and award grants/contracts deemed scientifically and programmatically relevant to breast cancer research.</li> <li>2392 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 97906</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>72951</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>75000</td> <td>97906</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-3881</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>71119</td> <td>97906</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+97906) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	72951	0	0	0	Adjustments to Appropriated Value	75000	97906			FY 1998 Pres Bud Request	-3881					71119	97906	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	72951	0	0	0																																
Adjustments to Appropriated Value	75000	97906																																		
FY 1998 Pres Bud Request	-3881																																			
	71119	97906	0	0																																

Project D806

Page 4 of 20 Pages

Exhibit R-2 (PE 0603002A)

317

Item 28

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT

D810

	COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D810 Industrial Base/Infectious Disease Vaccines and Drugs		8888	9034	8274	8504	8018	8129	8674	9096	Continuing	Continuing

**A. Mission Description and Justification:** This project funds development of medical countermeasures for naturally occurring diseases which are militarily significant due to their potential impact on military operations. Development of medical countermeasures will protect the force from infection and sustain operations by preventing hospitalization and evacuations from the theater of operations. Major contractors are the University of California, San Francisco, CA; SRI, Inc., Menlo Park, CA; Starks Associates, Inc., Buffalo, NY; ASH Stevens, Inc., Detroit, MI; Research Triangle Associates, Research Triangle Park, NC; Kenya Medical Research Institute, Nairobi, Kenya.

**FY 1996 Accomplishments:**

- 729 Conducted Phase I clinical safety trials of candidate *S. sonnei* NPS, *S. sonnei* LPS, and live attenuated *S. flexneri* vaccines.
- 2038 Initiated challenge studies of candidate malaria RTS,S vaccine; conducted serological analyses of serum specimens from field trials.
- 142 Conducted Phase II efficacy trial of ribavirin for treatment of viral hemorrhagic fevers.
- 781 Prepared field site for testing new antimalarial drug candidates.
- 3585 Transitioned at Milestone I one antimalarial vaccine.
- 206 Conducted field efficacy trials of camouflage facepaint repellent product and a combined repellent/sunscreen product; tested efficacy of a new repellent effective against flies.
- 1407 Prepared, purified, and bottled multivalent *shigella* and multivalent *dengue* virus candidate vaccines for human safety trials.
- 8888
- Total

**FY 1997 Planned Program:**

- 1671 Reformulate and test the vaccinia-vectored malaria vaccine candidate and conduct Phase I testing of the recombinant malaria vaccine candidate.
- 1497 Conduct Phase I testing of a *Shigella sonnei* proteosome-LPS intranasal vaccine, a *Shigella flexneri* live oral vaccine, and an adjuvanted multivalent killed whole cell *Campylobacter* vaccine. Microencapsulate *E. coli* antigens.
- 2693 Complete Phase I testing of topical treatment for cutaneous *Leishmaniasis*. Conduct Phase I testing of atovaquone-proguanil for prevention of multi drug-resistant malaria.
- 583 Conduct Phase I tests of attenuated *dengue* vaccine candidates. Begin the process of formulation of four attenuated monovalent candidates into one tetravalent candidate.
- 583 Document the occurrence of antimony-resistant *Leishmaniasis*, and validate the skin test and dipstick assay for *Leishmaniasis*. Field test the sunscreen/insect repellent combination and the self-supporting bednet.

Project D810

Page 5 of 20 Pages

Exhibit R-2 (PE 0603002A)

318

Item 28

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603002A Medical Advanced Technology</b>	<b>D810</b>	
<b>FY 1997 Planned Program: (continued)</b>			
• 263	Develop two improved group B meningitis vaccine candidates. Assess the sensitivity and specificity of the new dipstick diagnostic assay for scrub typhus. Evaluate the core glycolipid vaccine to prevent sepsis.		
• 219	Produce technical report on the efficacy of Junin vaccine against Machupo virus, and conduct Phase I testing of a multivalent Hantavirus vaccine. Test a hepatitis E vaccine candidate in animals.		
• 1305	Evaluate improved production and delivery methods for vaccines including <i>dengue</i> vaccine components and four formulations of malaria peptides.		
• 220	Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total	9034		
<b>FY 1998 Planned Program:</b>			
• 1525	Conduct animal testing on a multigene <i>P. falciparum</i> DNA vaccine, a liposome encapsulated <i>P. falciparum</i> sporozoite vaccine, and a <i>P. vivax</i> sporozoite synthetic peptide vaccine.		
• 1158	Conduct Phase I testing of a <i>Shigella sonnei</i> nucleoprotein subcellular vaccine, and conduct animal testing of a live <i>Campylobacter</i> vaccine. Evaluate encapsulated labile toxin as a mucosal adjuvant.		
• 2989	Conduct toxicology testing of a new drug to treat multi drug-resistant malaria (artelinic acid) and a new drug to prevent multi drug-resistant malaria (acridine analog).		
• 523	Conduct Phase I tests of an attenuated tetravalent <i>dengue</i> vaccine candidate. Standardize anti- <i>dengue</i> antibody assays.		
• 563	Test a dipstick for rapid detection of multi drug-resistant malaria, and initiate a survey of drug resistant <i>Leishmania</i> . Field test the computerized vector identification key.		
• 181	Conduct studies to optimize the parenteral group B meningitis vaccine candidate. Assess the sensitivity and specificity of the chromatographic handheld assay for scrub typhus.		
• 190	Publish a technical report on the antiviral efficacy of S-adenosyl homocysteine, and conduct Phase I trials on an immunoglobulin therapy for Crimean-Congo hemorrhagic fever. Conduct Phase I testing of a hepatitis E vaccine candidate.		
• 1145	Evaluate improved production and delivery methods for vaccines including multiple components and formulations of <i>Shigella</i> vaccine candidates. Evaluate PCR-microchip technology for forward deployable diagnostic assays for malaria.		
Total	8274		
<b>FY 1999 Planned Program:</b>			
• 1551	Conduct animal testing on a <i>P. vivax</i> multistage recombinant attenuated vaccinia-based vaccine and a <i>P. vivax</i> multigene DNA vaccine.		
• 1228	Conduct animal testing of a <i>Shigella dysenteriae</i> vaccine, conduct Phase I testing of a live <i>Campylobacter</i> vaccine, and test an <i>E. coli</i> stable toxin toxoid-colonization factor antigen fusion protein.		
• 3101	Conduct animal testing of a new drug to treat multi drug-resistant malaria (artelinic acid) and a new drug to prevent multi drug-resistant malaria (acridine analog).		
Project D810		Exhibit R-2 (PE 0603002A)	

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603002A Medical Advanced Technology</b>	<b>D810</b>																										
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>556 Conduct Phase I tests of tetraivalent killed whole virus <i>dengue</i> vaccine candidate.</li> <li>586 Initiate a survey of drug resistant malaria, and test a new ELISA diagnostic device for <i>Leishmania</i> infections. Field test a new and safer insect repellent to replace the current DEET insect repellent product.</li> <li>226 Conduct studies to optimize the mucosal group B meningitis vaccine candidate. Begin the two year program to assess the sensitivity and specificity of a gene detection kit to identify antibiotic resistance genes for scrub typhus.</li> <li>212 Conduct Phase I testing of a vaccine to prevent sandfly fever. Test combination vaccine candidates to counter all hepatitis threats.</li> <li>1044 Optimize production and delivery methods for vaccines including liposome, microencapsulation, and conjugation technology. Evaluate PCR-microchip technology for forward deployable diagnostic assays for dengue.</li> </ul> <p>Total 8504</p>																												
<p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>9117</td> <td>9228</td> <td>9309</td> <td>8673</td> </tr> <tr> <td>Appropriated Value</td> <td>9373</td> <td>9034</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-485</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>8888</td> <td>9034</td> <td>8274</td> <td>8504</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	9117	9228	9309	8673	Appropriated Value	9373	9034			Adjustments to Appropriated Value	-485				FY 1998 Pres Bud Request	8888	9034	8274	8504
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	9117	9228	9309	8673																								
Appropriated Value	9373	9034																										
Adjustments to Appropriated Value	-485																											
FY 1998 Pres Bud Request	8888	9034	8274	8504																								
<p>Change Summary Explanation: Funding: FY98: Funds reprogrammed (-1035) to higher priority requirements.</p>																												

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT  
D813

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D813 Trichloromelamine Testing	0	490	0	0	0	0	0	0	0	490

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for trichloromelamine (TCM) testing that includes a 90-day toxicity disinfectant study in a non-rodent species. Purpose of test is to provide appropriate EPA registration for Army future procurement for TCM suppliers, thus ensuring competition.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 478 Evaluate and award competitive contracts/grants to initiate research on trichloromelamine testing.
  - 12 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 490

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	0	0	0
Appropriated Value	0	490		
Adjustments to Appropriated Value				
FY 1998 Pres Bud Request	0	490	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+490) provided by Congressional action.

Project D813

Page 8 of 20 Pages

Exhibit R-2 (PE 0603002A)

321

Item 28

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
3 - Advanced Technology Development		0603002A Medical Advanced Technology								D814																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
D814	Neurofibromatosis	0	7832	0	0	0	0	0	0	0	7832																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for neurofibromatosis.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 7640 Evaluate and award competitive contracts/grants to initiate research on neurofibromatosis.</li> <li>• 192 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 7832</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>7832</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>7832</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+7832) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	7832			FY 1998 Pres Bud Request	0	7832	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	7832																													
FY 1998 Pres Bud Request	0	7832	0	0																											

Project D814

Page 9 of 20 Pages

Exhibit R-2 (PE 0603002A)

322

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT

D815

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D815 National Medical Testbed	0	5874	0	0	0	0	0	0	0	5874

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for national medical testbed which display measurable improvements in cost and effectiveness in many areas of health care delivery.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 5731 Evaluate and award competitive contracts/grants to initiate research on national medical testbed.
- 143 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 5874

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
0	0	0	0
0	5874		
0	5874	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+5874) provided by Congressional action.

Project D815

Page 10 of 20 Pages

Exhibit R-2 (PE 0603002A)

323

Item 28

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
3 - Advanced Technology Development		0603002A Medical Advanced Technology								D816																					
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
D816	Computer-Based Decision Support System	0	5874	0	0	0	0	0	0	0	5874																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for computer-based decision support system to allow patients to better understand the diagnosis, treatment options, and risk factors associated with treatment.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5731 Evaluate and award competitive contracts/grants to initiate research on computer-based decision support system.</li> <li>143 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 5874</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>5874</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>5874</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+5874) provided by Congressional action.</p>												FY1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	5874			FY 1998 Pres Bud Request	0	5874	0	0
FY1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	5874																													
FY 1998 Pres Bud Request	0	5874	0	0																											

Project D816

Page 11 of 20 Pages

Exhibit R-2 (PE 0603002A)

324

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT

D817

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D817 Computer-Aided Diagnostic Research	0	2937	0	0	0	0	0	0	0	2937

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for computer-aided diagnostic research which utilizes image enhancement and segmentation by adaptive multiresolution/multiorientation wavelet transform methods, which are suitable for more generalized application useful to DoD in digital mammography, digital x-ray imaging, and teleradiology applications.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 2865 Evaluate and award competitive contracts/grants to initiate research on computer-aided diagnostic research.
  - 72 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 2937

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	0	0	0	0
Appropriated Value	0	2937		
Adjustments to Appropriated Value				
FY 1998 Pres Bud Request	0	2937	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+2937) provided by Congressional action.

Project D817

Page 12 of 20 Pages

Exhibit R-2 (PE 0603002A)

325

Item 28

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																				
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																					
3 - Advanced Technology Development		0603002A Medical Advanced Technology								D818																					
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																				
D818	Advanced Cancer Detection Center	0	3427	0	0	0	0	0	0	0	3427																				
<p><b>A. Mission Description and Justification:</b> By Congressional direction, the purpose of this project is to develop initial research models for advanced cancer detection center for military personnel, dependents, and retired service members, using a network including a military hospital or hospitals, a regional TRICARE provider, a Department of Veteran Affairs hospital or hospitals, and a medical facility with a focused cancer center, in order to conduct coordinated screening for early detection and treatment to train military cancer specialists, and to develop improved cancer detection equipment and technology.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>3343 Evaluate and award competitive contracts/grants to initiate research on advanced cancer detection center.</li> <li>84 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 3427</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>0</td> <td>3427</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>0</td> <td>3427</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997: Funding (+3427) provided by Congressional action.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	0	0	0	0	Adjustments to Appropriated Value	0	3427			FY 1998 Pres Bud Request	0	3427	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																											
Appropriated Value	0	0	0	0																											
Adjustments to Appropriated Value	0	3427																													
FY 1998 Pres Bud Request	0	3427	0	0																											

Project D818

Page 13 of 20 Pages

Exhibit R-2 (PE 0603002A)

326

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

D819

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D819 Field Medical Protection and Human Performance Enhancement-Non-Systems Advanced Development	1683	2350	0	0	207	202	581	602	Continuing	Continuing

**A. Mission Description and Justification:** This project supports laboratory validation studies and field demonstrations focused on soldier protection, sustainment, and enhancement associated with soldiers operating, wearing and consuming materiel systems in all climatic and operational conditions. Specific support includes medical non-systems advanced development of laser eye protection technologies and laser bioeffects treatment, medical protection against military electromagnetic radiation hazards, environmental health monitoring methods to link soldier physiological status with climatic and environmental conditions, methods to enhance sleep and alertness during continuous/sustained operational scenarios, nutritional strategies to enhance soldier mental and physiological performance, and medical protection from vibration and repeated shock hazards arising from the operation of combat vehicle and aircraft systems. Research efforts are categorized by five major thrust areas: Operational Medicine and Performance; Environmental Extremes; Directed Energy Bioeffects; Toxic Hazards Health Effects; and Biodynamic Stresses.

**FY 1996 Accomplishments:**

- 1683 Studied physical and mental performance requirements of combat soldiers to extend performance limits. Evaluated performance effects of various nutrient supplements.

Total 1683

**FY 1997 Planned Program:**

- 2293 Using noninvasive sensors and stable isotope technologies, establish a database of energy requirements and activity patterns for men and women in Army, Navy, and Marine Corps jobs to predict and plan for voluntary energy requirements.
- 57 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2350

**FY 1998 Planned Program:** Program not funded in FY 98.**FY 1999 Planned Program:** Program not funded in FY 99.

Project D819

Page 14 of 20 Pages

Exhibit R-2 (PE 0603002A)

327

Item 28

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603002A Medical Advanced Technology</b>	<b>D819</b>	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	1727	0	0
Adjustments to Appropriated Value	1775	2350	
FY 1998 Pres Bud Request	-92		
	1683	2350	0
Change Summary Explanation: Funding: FY 1997: Funding (+2350) provided by Congressional action.			

Project D819

Page 15 of 20 Pages

Exhibit R-2 (PE 0603002A)

328

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT

D840

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D840 Combat Injury Management		2264	2324	2403	2455	2466	2495	2731	2845	Continuing	Continuing

**A. Mission Description and Justification:** This project funds advanced development prototypes of non-system specific medical materiel items for far-forward medical management of shock and trauma, and for casualty resuscitation, including pre-clinical testing of large standard lots of candidate compounds and equipment, to obtain data necessary for Food and Drug Administration (FDA) approval for human use. A major contractor is the University of North Carolina, Chapel Hill, NC.

**FY 1996 Accomplishments:**

- 715 Conducted human studies of candidate preservation systems for eight week refrigerated red blood cell storage.
- 732 Investigated effect of intravenous membrane oxygenation on end organ function and in prevention of respiratory insufficiency due to Adult Respiratory Distress Syndrome (ARDS).
- 318 Designed and refined engineering for prototype of the mobile Advanced Surgical Suite for Trauma Casualties (ASSTC).
- 499 Conducted initial prototyping of a ruggedized portable oxygen concentrator for field use.
- Total 2264

**FY 1997 Planned Program:**

- 716 Conduct clinical studies to evaluate fibrin-base hemostatic bandage formulation for hemorrhage control.
- 732 Evaluate clinical efficacy of oxygen administration in trauma patients.
- 199 Evaluate efficacy of tobramycin and vancomycin microspheres against antibiotic resistant strains of *P. aeruginosa*; conduct acute toxicological studies of cefazolin microspheres in two animal species to enable transition to advanced development.
- 121 Submit Investigational New Drug (IND) exemption for Phase I testing of topical analgesic/anesthetic products; complete animal testing of prototype field anesthesia machine.
- 499 Design prototype omni-directional maneuverable platform for robotic surgical assistant test bed.
- 57 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 2324

Project D840

Page 16 of 20 Pages

Exhibit R-2 (PE 0603002A)

329

Item 28

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603002A Medical Advanced Technology</b>	<b>D840</b>	
<b>FY 1998 Planned Program:</b>			
• 602	Complete laboratory validation of individual, far-forward version of the microwave resuscitation fluid warmer.		
• 400	Transition non-invasive deep tissue pH and deep tissue oxygen sensors to advanced development.		
• 799	Transition "Life Support for Trauma and Transport (LSTAT) 1996 Test Article" (prototype version with FDA-approved, Commercial Off The Shelf (COTS) equipment) to advanced development.		
• 602	Transition ASSTC to advanced development.		
Total	2403		
<b>FY 1999 Planned Program:</b>			
• 802	Transition DataPak individual physiologic sensor suite to advanced development.		
• 851	Transition non-invasive intracranial pressure monitor to advanced development.		
• 802	Transition Medical Decision Assist algorithm(s) to advanced development.		
Total	2455		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	2322	2373	2397
Adjustments to Appropriated Value	2387	2324	
FY 1998 Pres Bud Request	-123		
	2264	2324	2403
			2455

Project D840

Page 17 of 20 Pages

Exhibit R-2 (PE 0603002A)

330

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

D887

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D887 Ovarian Cancer Research	0	7343	0	0	0	0	0	0	0	7343

**A. Mission Description and Justification:** By Congressional direction, the purpose of this project is to develop initial research models for a comprehensive preventative program in ovarian cancer that expands into endometrial, cervical, and other cancer research that would include prevention planning, implementation, and development planning.

**FY 1996 Accomplishments:** Program not funded in FY 96.

**FY 1997 Planned Program:**

- 7164 Evaluate and award competitive contracts/grants to initiate research on ovarian cancer research.
  - 179 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 7343

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
0	0	0	0
0	7343		
0	7343	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+7343) provided by Congressional action.

Project D887

Page 18 of 20 Pages

Exhibit R-2 (PE 0603002A)

331

Item 28

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
3 - Advanced Technology Development		0603002A Medical Advanced Technology								D892																										
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
D892	Blood Analyzer	1897	0	0	0	0	0	0	0	0	1897																									
<p><b>A. Mission Description and Justification:</b> By Congressional direction, this project supports research on blood analyzers.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 1897 Evaluated competitive contracts/grants to initiate research on blood analyzers.</li> </ul> <p>Total 1897</p> <p><b>FY 1997 Planned Program:</b> Project not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b> Program not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Program not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>1946</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2000</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-103</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td></td> <td>1897</td> <td></td> <td></td> <td></td> </tr> </table>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	1946	0	0	0	Adjustments to Appropriated Value	2000				FY 1998 Pres Bud Request	-103	0	0	0		1897			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	1946	0	0	0																																
Adjustments to Appropriated Value	2000																																			
FY 1998 Pres Bud Request	-103	0	0	0																																
	1897																																			

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603002A Medical Advanced Technology

PROJECT

D893

	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D893 Tissue Replacement	4740	11749	0	0	0	0	0	0	0	16489

**A. Mission Description and Justification:** By Congressional direction, this project supports tissue replacement.

## FY 1996 Accomplishments:

- 4740 Began process for evaluating competitive contracts/grants to initiate research on tissue replacement.
- Total 4740

## FY 1997 Planned Program:

- 11462 Evaluate and award competitive contracts/grants to initiate research on tissue replacement.
  - 287 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 11749

**FY 1998 Planned Program:** Program not funded in FY 98.

**FY 1999 Planned Program:** Program not funded in FY 99.

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	4863	0	0	0
Appropriated Value	5000	11749		
Adjustments to Appropriated Value	-260			
FY 1998 Pres Bud Request	4740	11749	0	0

Change Summary Explanation: Funding: FY 1997: Funding (+11749) provided by Congressional action.

Project D893

Page 20 of 20 Pages

Exhibit R-2 (PE 0603002A)

333

Item 28

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603003A Aviation Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	48320	56165	31330	29921	39432	42715	48317	58612	Continuing	Continuing
D313 Advanced Rotary Wing Vehicle Technology	3110	3453	6013	17031	26113	24474	29136	37043	Continuing	Continuing
D391 Tractor Will	6104	4934	973	954	966	0	0	0	0	14671
D435 Aircraft Weapons	2809	0	0	0	3182	7549	7041	6691	Continuing	Continuing
D436 Rotary-Wing MEP Integration	20936	24022	17366	5080	2026	3614	5178	7809	Continuing	Continuing
D447 Aircraft Demonstration Engines	6538	7617	6580	6598	7145	7078	6962	7069	Continuing	Continuing
DA38 Starstreak	3794	14686	0	0	0	0	0	0	0	18578
DE38 TRACTOR CONE	567	979	0	0	0	0	0	0	0	582
DB97 Aircraft Avionics Equipment	4462	474	398	258	0	0	0	0	0	5686

**Mission Description and Budget Item Justification:** The objective of this program element (PE) is to develop, demonstrate, and transition aeronautical technologies for new and/or upgrades to DoD/Army Vertical Take-off and Landing (VTOL) airborne systems. Helicopter rotors provide low disc loading as compared to the tilt rotor's intermediate disc loading and vertical lift jet engine's high disc loading. Low disc loading VTOL aircraft offer a practical solution to many of the DoD/Army's operational needs. Such aircraft, with their ability to operate below tree top level for Nap-of-the-Earth (NOE) missions, present significantly different analysis and design challenges from traditional fixed wing aircraft which fly at higher altitudes. The Army Aviation Science and Technology program's functional organization, with assistance from National Aeronautics and Space Administration (NASA) at three co-located activities, is the focal point for US efforts in rotorcraft technology. Technology areas for development/demonstration include aeromechanics, aerodynamics, structures, propulsion, reliability and maintainability, safety and survivability, mission support equipment integration, aircraft subsystems, advanced helicopter rotors and flight controls, flight simulation, aircrew-aircraft system integration, aircraft weapons integration for air-to-air/air-to-ground, aircraft avionics for command and control, communications, controls and displays, digital avionics and architectures, NOE navigation, mission planning, air traffic management and investigation and selective application of Integrated Product and Process Development (IPPD) techniques in development/demonstration of these technology efforts. These technologies are continuously being researched for applications that will improve and correct deficiencies in current DoD/Army VTOL aircraft systems, and to improve the capabilities of future rotorcraft. The work in this PE is consistent with the Army Science and Technology Master Plan (ASTMP), Army

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603003A Aviation Advanced Technology

Modernization Plans, and DoD Project Reliance agreements. This program is dedicated to conducting proof-of-principle simulations, field demonstrations, and tests of technologies to meet specific military needs and is therefore appropriately funded in Budget Activity 3.

Work in this PE is performed by contractors including Georgia Institute of Technology, Atlanta, GA; McDonnell Douglas Helicopter Systems, Mesa, AZ; Boeing Helicopter Company, Philadelphia, PA; Loral Western Development Laboratories, San Jose, CA; Bell Helicopter Textron Incorporated, Ft. Worth, TX; Martin Marietta, Atlanta, GA; General Electric, Lynn, MA; Allied Signal Engines, Phoenix, AZ; Honeywell, Minneapolis, MN; Sikorsky, Stratford, CT; BDM International, Albuquerque, NM; MITRE, McLean, VA; Shorts Missile Systems, Belfast Northern Ireland, and CAE Electronics, Montreal, Canada.

Primary in-house developers of the technology under this program element include Simulation, Training and Instrumentation Command (STRICOM), Orlando, FL; Aviation and Troop Command (ATCOM), St. Louis, MO; Communications-Electronics Command (CECOM), Ft. Monmouth, NJ; Aeroflightdynamics Directorate, ATCOM, NASA Ames Research Center, Moffett Field, CA; Aviation Applied Technology Directorate, ATCOM, Ft. Eustis, VA; Vehicle Structures Directorate, Army Research Laboratory (ARL), NASA Langley Research Center, Hampton, VA; and Vehicle Propulsion Directorate, ARL, NASA Lewis Research Center, Cleveland, OH. Related activities are performed by National Aeronautics and Space Administration.

This program adheres to DoD Project Reliance Agreements on Aeropropulsion and Air Vehicles (Rotary) with oversight (the Army is designated the lead DoD agency for rotorcraft technology) and coordination provided by the Joint Directors of Laboratories; and Training Systems with oversight and coordination provided by the Training and Personnel Systems Science & Technology Evaluation Management Committee (TAPSTEM). Related concept exploration is conducted under PE 0602211A (Aviation Technology). Efforts under this PE transition and provide risk reduction for and lead into Demonstration/Validation and Engineering Development programs supported by PE 0603801A (Aviation - Advanced Development), PE 0604801A (Aviation - Engineering Development) and PE 0604270A (Electronic Warfare Development). In addition, this PE's deliverables provide technical support and technology transition to PE 0604223A (RAH-66 Comanche), PE 0604816A (Longbow), and PE 0203744A (Aircraft Modifications/Product Improvement).

The Army participates in and with the following groups, organizations and programs for total coordination: the DoD Tri-Service Joint Technical Coordination Group for Munitions Development and Aircraft Survivability; Aircraft Instruments and Aircrew Station Working Group; the Joint Integrated Avionics Working Group (JIAWG); Integrated High Performance Turbine Engine Technology (IHPTET) Steering Committee; the Air Armament Working Party of NATO; and the Executive Steering Committee for the Rotorcraft Pilot's Associate (RPA) Program. This participation enables the gathering of technical information and assets in determining the joint use and standardization of airborne weaponization items. The Army Munitions Research and Development Committee, an organization within the Office of the Secretary of Defense, functions to establish Joint Service requirements and the development of air munitions. International related activities are the Technical Cooperation Programs with Australian, Canadian and United Kingdom governments, and Defense Development Share Plans. Formal Memoranda of Understanding (MOUs) and Data Exchange Agreements (DEAs) with various friendly nations are actively pursued to allow technology information exchange. There is no unnecessary duplication of effort within the Army or Department of Defense.

UNCLASSIFIED



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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603003A Aviation Advanced Technology								D313	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D313	Advanced Rotary Wing Vehicle Technology	3110	3453	6013	17031	26113	24474	29136	37043	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides for conduct of rotary-wing technology demonstrations in support of research for advanced rotors/controls, flight controls, airframes/structures, and drive-trains to: increase strategic/tactical mobility; increase maneuverability/agility; increase reliability through improved maintainability/sustainability and reduced operational cost. Technologies developed will be executed in four demonstrations: Rotary-Wing Structures Technology (RWST), Advanced Rotorcraft Transmission Phase II (ART-II), Rotorcraft Pilot's Associate (RPA) and Helicopter Active Control Technology (HACT). These demonstrations will focus the enabling technologies for the Joint Transport Rotorcraft (JTR) to meet the cargo/transport and commuter needs of the military and civilian sectors, as well as technology insertion for other system upgrades. This project focuses on technologies to enable rotorcraft to affordably meet future challenges from peacekeeping to the battlefield.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 3110 - Initiated ART-II preliminary design.</li> <li>-Completed flight testing of autonomous scout rotorcraft testbed (ASRT) demonstrators.</li> <li>-Supported hotbench/platform integration of RPA technologies.</li> </ul> <p>Total 3110</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3368 -Define structural configuration and requirements and develop integrated system architecture for rapid structural concept definition as part of the RWST technology demonstration.</li> <li>-Complete ART-II detailed design and initiate long lead hardware procurement.</li> <li>• 85 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 3453</p>											
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4000 -Conduct ART II component validation test; evaluate and finalize ART II design and initiate procurement of final design long lead hardware.</li> <li>• 493 -Initiate HACT system definition/development.</li> <li>• 1520 -Initiate virtual structural prototype and conduct preliminary design of efficient, affordable structural concepts to satisfy configuration requirements, as part of the RWST technology demonstration.</li> </ul> <p>Total 6013</p>											
Project D313											

Exhibit R-2 (PE 0603003A)

Page 3 of 12 Pages

336

Item 29

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603003A Aviation Advanced Technology

PROJECT

D313

## FY 1999 Planned Program:

- 9000 -Initiate buildup of major ART-II drivetrain subsystems; perform initial testing of ART-II subsystems and conduct noise survey of ART II initial subsystems.
  - 3183 -Complete HACT system definition and initiate detailed design.
  - 4848 -Validate virtual prototype/structural configuration detailed design as part of the RWST technology demonstration.
- Total 17031

## B. Project Change Summary

	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
FY 1997 President's Budget	4839	3527	9139	15822
Appropriated Value	4975	3453		
Adjustments to Appropriated Value	-1865			
FY 1998 Pres Bud	3110	3453	6013	17031

Change Summary Explanation: Funding: FY 1996 funding reprogrammed (-1865) to higher priority requirements.  
 FY 1998 funding reprogrammed (-3126) to higher priority requirements.  
 FY 1999 funding increased (+1209) to support rotary wing structures technology program

Project D313

Page 4 of 12 Pages

Exhibit R-2 (PE 0603003A)

337

Item 29

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
3 - Advanced Technology Development		0603003A Aviation Advanced Technology								D435																										
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
D435	Aircraft Weapons	2809	0	0	0	3182	7549	7041	6691	Continuing	Continuing																									
<p><b>A. Mission Description and Justification:</b> This project demonstrates rotorcraft weaponization technologies utilizing an integrated system approach. Integration of advanced missile, rocket and gun system fire control, target acquisition and weapon system selection processes are demonstrated. This project supports Rotorcraft Pilot's Associate (RPA) program.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2809 -Completed weapons and target acquisition knowledge development portion of mission operation as part of the RPA detailed design.</li> <li>-Completed development of RPA weapons and target acquisition simulation models.</li> <li>-Conducted detailed design of the Cognitive Decision Aiding (CDA) Attack Planner for RPA.</li> </ul> <p>Total 2809</p> <p><b>FY 1997 Planned Program:</b> Project not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>2881</td> <td>0</td> <td>0</td> <td>1918</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2963</td> <td>0</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-154</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2809</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1999 funding reprogrammed (-1918) to higher priority requirements.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	2881	0	0	1918	Adjustments to Appropriated Value	2963	0			FY 1998 Pres Bud Request	-154					2809	0	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	2881	0	0	1918																																
Adjustments to Appropriated Value	2963	0																																		
FY 1998 Pres Bud Request	-154																																			
	2809	0	0	0																																

Project D435

Page 5 of 12 Pages

Exhibit R-2 (PE 0603003A)

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603003A Aviation Advanced Technology

D436

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D436 Rotary-Wing MEP Integration	20936	24022	17366	5080	2026	3614	5178	7809	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is to demonstrate man-machine integration and mission equipment technology to provide enhanced helicopter pilotage capability, improved crew workload distribution and improved overall mission execution. This is the primary project for the Rotorcraft Pilot's Associate (RPA) Advanced Technology Demonstration (ATD). It provides for the demonstration of rotorcraft crew stations utilizing knowledge-based information systems to develop Cognitive Decision Aiding (CDA) for crews. Advanced technology in information technology computing methods, sensors, displays, and controls will be demonstrated to maximize combat helicopter mission effectiveness and survivability for day/night adverse weather operations. The project provides for the demonstration of simulation capability to evaluate combined rotorcraft control and crew performance via virtual prototyping and Distributed Interactive Simulation (DIS). The RPA system will use state-of-the-art approaches in artificial intelligence, sensors, avionics, communications, and pilot vehicle interfaces, that augments the battlefield effectiveness of Army aviation.

## FY 1996 Accomplishments:

- 13007 -Completed RPA hardware detail design and software system builds 2 and 3, initiated fabrication, modification, and integration activities for the flight test vehicle.
  - Completed high fidelity engineering simulation environment to support development and engineering evaluation of the RPA; included full fidelity mission equipment models that interface directly with RPA core architecture.
  - Continued knowledge acquisition collection and refinement for scout/attack and Special Operations aviation forces mission.
  - 7929 -Maintained and improved combined arms simulation capabilities through SPIRIT commitments.
  - Refined operational evaluation techniques and performed RPA system performance evaluations during concurrent software development activities.
- Total 20936

## FY 1997 Planned Program:

- 18591 -Complete knowledge acquisition collection activities and software detailed design; perform system builds 4, 5 and 6; conduct software critical design review.
- Conduct engineering and full mission simulation System Formal Evaluations I & II.
- Perform subsystems integration, ground-based testing, and airborne validation in preparation for the FY 1998 RPA system flight evaluation at Fort Hunter-Leggett.
- 4844 -Maintain and improve combined arms simulation capabilities through SPIRIT commitments.

Project D436

Page 6 of 12 Pages

Exhibit R-2 (PE 0603003A)

339

Item 29

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE \_\_\_\_\_

February 1997

### BUDGET ACTIVITY

PE NUMBER AND TITLE

### 3 - Advanced Technology Development

**0603003A Aviation Advanced Technology**

## PROJECT

**D436**

**FY 1997 Planned Program: (continued)**

**g-Refine** operational evaluation techniques and perform RPA system performance evaluations during concurrent software development activities in preparation for the FY 1998 full system combined arm distributed simulation wargaming evaluations.

•	587
Total	24022

**FY 1998 Planned Program:**

- Complete development of core architecture software; integrate and test Version 6 software; conduct performance demonstration; conduct engineering/integration flight testing; conduct operational evaluation flight testing; conduct government/industry system demonstrations (simulation and flight test).

Total	17366
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**FY 1999 Planned Program:**

- Complete RPA simulation and flight test; complete data reduction, analysis, final report/briefing and transition RPA technology and lessons learned to fielded/development systems and follow-ons.

Total	5080
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### **B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud

FY 1996

20650

21230

-294

20936

FY 1997

24647

24022

1

FY 1998

18261

FY 1999

14672

Change Summary Explanation: Funding: FY 1999 funding reprogrammed (-9592) to higher priority requirements.

Project D436

Page 7 of 12 Pages

Exhibit R-2 (PE 0603003A)

340

Item 29

**UNCLASSIFIED**

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603003A Aviation Advanced Technology								D447	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D447	Aircraft Demonstration Engines	6538	7617	6580	6598	7145	7078	6962	7069	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The objective of this project is to competitively perform design, fabrication and test of advanced technology engines and integrated components to demonstrate achievable improved performance levels for current and future DoD aircraft emphasizing Army unique requirements. The current/planned Joint Turbine Advanced Gas Generator (JTAGG) efforts are all fully coordinated/aligned with the phases/goals of the DoD Integrated High Performance Turbine Engine Technology (IHPTET) program and industry. IHPTET/JTAGG goals focus on reducing specific fuel consumption (SFC) and increasing the power to weight (P/W) ratio of turboshaft engines.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>6538 -Completed initial JTAGG II component test.</li> <li>-Performed gas generator fabrication and build-up.</li> <li>-Initiated gas generator test.</li> </ul> <p>Total 6538</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>7430 -Complete final component updated design.</li> <li>-Perform final component fabrication.</li> <li>-Perform final component tests.</li> <li>-Initiate JTAGG fabrication and build-up.</li> <li>-Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 187 7617</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6580 -Complete endurance testing of JTAGG II, evaluate results and complete final report.</li> </ul> <p>Total 6580</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>6598 -Complete JTAGG III detail design, procure long-lead hardware and conduct initial component testing.</li> </ul> <p>Total 6598</p>											

Project D447

Page 8 of 12 Pages

Exhibit R-2 (PE 0603003A)

341

Item 29

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603003A Aviation Advanced Technology</b>		<b>D447</b>	
<b>B. Project Change Summary</b>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
FY 1997 President's Budget	6963	7780	6588	6608
Appropriated Value	7158	7617		
Adjustments to Appropriated Value	-620			
FY 1998 President's Budget Request	6538	7617	6580	6598

Project D447

Page 9 of 12 Pages

Exhibit R-2 (PE 0603003A)

342

Item 29

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603003A Aviation Advanced Technology

PROJECT

DA38

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DA38 Starstreak	3794	14686	0	0	0	0	0	0	0	18578

**A. Mission Description and Justification:** The objective of this Congressionally mandated project is to investigate air-to-air (ATA) applications of the Starstreak missile on rotary wing platforms. Technical feasibility of the Starstreak missile integration on a rotary wing platform will be determined through analysis and flight tests. A missile system cost estimate will be performed as part of a preliminary assessment of the military worth of the Starstreak missile as an ATA self defense weapon.

**FY 1996 Accomplishments:**

- 3794 -Conducted safe separation testing of Starstreak missile firings from an AH-64, completed data analysis and published findings.
- Awarded Technical Demonstration (TD) contract to conduct live fire tests from an AH-64 to assess technical feasibility of the Starstreak missile/rotorcraft integration as an ATA self-defense weapon.
- Conducted safe separation live fire tests using the Apache / Starstreak.
- Conducted limited simulation evaluations of Apache / Starstreak warfighting effectiveness in the ATA self-defense role.

Total 3794

**FY 1997 Planned Program:**

- 14327 -Conduct detailed design, analysis and simulation, including TADS/LGU integration and crew station integration; fabricate and integrate AH-64A and Starstreak system modifications; conduct modeling and simulation of the integrated system in a few-on-few environment; conduct demonstration flight testing including airborne tracking trials, flight envelope verification, and live fire tests against airborne targets.
- 359 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 14686

**FY 1998 Planned Program:** Effort completed with FY 1997 funding.**FY 1999 Planned Program:** Effort completed with FY 1997 funding.**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
Previous President's Budget	3892	0	0	0
Appropriated Value	4000	14686		
Adjustments to Appropriated Value	-206			
Current Budget Submit/President's Budget	3794	14686	0	0

Project DA38

Page 10 of 12 Pages

Exhibit R-2 (PE 0603003A)

343

Item 29

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
	0603003A Aviation Advanced Technology		
3 - Advanced Technology Development			DB97

## 3 - Advanced Technology Development

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DB97 Aircraft Avionics Equipment	4462	474	398	258	0	0	0	0	0	5686

**A. Mission Description and Justification:** This project supports development and demonstration of advanced, integrated avionics equipment in support of aviation integration into the digitized battlefield. Evolving concepts in digital avionics will provide new functional capability in the areas of situational awareness, flight path guidance, position reporting and digital data transfer. Work in this project supports the Rotorcraft Pilot's Associate (RPA) program. The project effort in the out years will pursue application of low cost avionics integration/demonstration based on commercial products/technologies.

## FY 1996 Accomplishments:

- 1742 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.
- Completed knowledge acquisition sessions on communications, navigation, and pilotage aspects of mission operation.
- Completed development of communications, navigation, and pilotage simulation models.
- 2720 -Conducted detail design and evaluation of the data fusion algorithms including direct stimulus from the mission equipment simulation models.
- Conducted detail design of the RPA hardware.

Total 4462

## FY 1997 Planned Program:

- 462 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.
- 12 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 474

## FY 1998 Planned Program:

- 398 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.

Total 398

## FY 1999 Planned Program:

- 258 -Provide RPA mission equipment integration support in the areas of communication, navigation, pilotage, voice recognition, controls and displays, and artificial intelligence.

Total 258

Project DB97

Page 11 of 12 Pages

Exhibit R-2 (PE 0603003A)

344

Item 29

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
3 - Advanced Technology Development	0603003A Aviation Advanced Technology		DB97	
B. Project Change Summary	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	4577	484	385	240
Appropriated Value	4705	474		
Adjustments to Appropriated Value	-243			
FY 1998 President's Budget	4462	474	398	258

Project DB97

Page 12 of 12 Pages

Exhibit R-2 (PE 0603003A)

345

Item 29

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE									
3 - Advanced Technology Development		0603004A Weapons and Munitions Advanced Technology									
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		29119	29122	18255	29717	38074	42361	43405	42488	Continuing	Continuing
DL94	Electric Gun Systems Demonstrations	0	0	0	482	5720	5367	5569	5948	Continuing	Continuing
DL95	Landmine Warfare Development	3427	2117	0	0	0	0	0	0	0	5544
D43A	Advanced Weaponry Technology Demonstration	20712	21353	6234	17691	17830	20113	21098	20660	Continuing	Continuing
D232	Advanced Munitions Demonstration	4980	5652	12021	11544	14524	16881	16738	15880	Continuing	Continuing

**Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to demonstrate affordable, advanced weapons and munitions technologies that will increase battlefield lethality and survivability. This PE funds several stand-off, anti-armor weapons demonstrations within the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) to significantly increase the capability of Early Entry Forces. The RFPI demonstrations funded within this PE include: the Precision Guided Mortar Munition (PGMM), Autonomous Intelligent Submunition (AIS-Damocles), and more responsive digitized fire control for a towed 155mm automated howitzer (AH). An initiative in response to recent threat information, especially against new explosive reactive armors (which appears as appliques), is the Direct Fire Lethality Program, the purpose of which is to significantly enhance anti-tank lethality in terms of hit and kill by maximizing warhead/penetrator effectiveness and significantly increase tank gun accuracy under dynamic battlefield conditions. In the area of combat vehicle anti-armor munitions, advanced explosively formed penetrator warheads exploit technologies in explosives, liner materials and modeling, and demonstrate increased armor penetration through advanced warhead concepts. Technologies were Congressionally supported in FY1996 to demonstrate an artillery projectile capable of delivering dual purpose improved conventional munition (DPICM) cargo to ranges in excess of 40 kilometers. Innovative applications for electro-rheological (ER) fluids are also Congressionally supported in FY1996 and FY1997 for use in next generation artillery recoil mechanisms. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. This program is primarily managed by the U.S. Army Armaments Research and Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ. This program adheres to Tri-Service Reliance Agreements on conventional air-surface weaponry with oversight provided by the Joint Directors of Laboratories. Work in this PE is related to and fully coordinated with efforts in PE 0602624A (Weapons and Munitions Technology), PE 0602618A (Ballistics Tech) and PE 0604802A (Weapons and Munitions-Engineering Development). This work is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603004A Weapons and Munitions Advanced Technology

DL94

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DL94 Electric Gun Systems Demonstrations	0	0	0	482	5720	5367	5569	5948	Continuing	Continuing

**A. Mission Description and Justification:** Recognizing that the feasibility of electric guns depends on overcoming fundamental technical barriers, the Army's electric gun program is structured to accelerate electronics and hypervelocity physics research, thereby understanding the fundamental underpinnings of electric guns. Accordingly, the program is managed by the Army Research Laboratory (ARL) for their unique expertise in physics research. Once the fundamental technical barriers are identified, the program will be transitioned to ARDEC for evaluation against the requirements of Army systems.

**FY 1996 Accomplishments:** Project not funded in FY 96. Electric gun efforts funded in PE/Project 0602618/AH75.

**FY 1997 Planned Program:** Project not funded in FY 97. Electric gun efforts funded in PE/Project 0602618/AH75.

**FY 1998 Planned Program:** Project not funded in FY 98. Electric gun efforts funded in PE/Project 0602618/AH75.

**FY 1999 Planned Program:**

- 482 - Finalize acquisition strategy for Future Combat System (FCS) main armament system; conduct testing of Focused Technology Program (FTP) compulsator.

Total 482

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
0	0	0	482
0	0	0	482

Project DL94

Page 2 of 9 Pages

Exhibit R-2 (PE 0603004A)

347

Item 30

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603004A Weapons and Munitions Advanced

DL95

## Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DL95 Landmine Warfare Development	3427	2117	0	0	0	0	0	0	0	5544

**A. Mission Description and Justification:** This project funds the Intelligent Minefield (IMF) demonstration, which is an anti-armor weapon candidate under the Rapid Force Projection Initiative (RFPI) and which provides product improvement opportunities for the Wide Area Munition (WAM). The IMF will demonstrate the flexibility and battlefield effectiveness of coordinated smart mine attack utilizing artificial intelligence (AI), decision aids, automatic target recognition (ATR), intermine communication, and extended range command and control. Mines that can defeat targets over a wide area have a tremendous payoff, especially for light forces that are weight and space constrained when they deploy. Additionally, anti-tank features such as a high probability of kill provided by top attack and command and control (e.g., on/off capability) make such mines very effective force multipliers. The IMF will include advanced acoustic sensors to cue mines as well as to provide remote sensors for the RFPI "hunter/stand-off killer" concept. The IMF advanced acoustic sensor sub-system re-configured as the integrated acoustic system (IAS) is a key residual sensor component of the RFPI ACTD Program. In-house efforts are accomplished by Armament Research Development and Engineering Center, Picatinny Arsenal, NJ.

## FY 1996 Accomplishments:

- 1973 - Conducted mission analysis, systems analysis and engineering of the IMF system.
- Designed, fabricated and integrated ATD hardware for use with WAM surrogates.
- Developed algorithms for improved IMF performance and integrated into gateway and IMF simulator.
- 1454 - Completed development of the distributed interactive simulation (DIS) compatible IMF simulator.
- Completed development and test of near and deep deployed acoustic sensors and associated communications links for RFPI.

Total 3427

## FY 1997 Planned Program:

- 2069 - Complete IMF ATD including analysis and report.
- Modify advanced acoustic sensors to meet RFPI ACTD "residual" requirements.
- Conduct field test and system integration of integrated acoustic system for RFPI ACTD.
- 48 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs

Total 2117

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

Project DL95

Page 3 of 9 Pages

Exhibit R-2 (PE 0603004A)

348

Item 30

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY		PROJECT	
3 - Advanced Technology Development		DL95	
PE NUMBER AND TITLE		0603004A Weapons and Munitions Advanced Technology	
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	2897	2178	2402
Adjustments to Appropriated Value	2978	2117	
FY 1998 Pres Bud Request	+449		
	3427	2117	0
			0
<p>Change Summary Explanation: Funding: FY 1996 funds increased (+530) for development of acoustic sensors for the RFPI.  FY 1998 funds reprogrammed (-2402) to higher priority requirements.  FY 1999 funds reprogrammed (-4608) to higher priority requirements.</p>			

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603004A Weapons and Munitions Advanced

D43A

## Technology

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D43A Advanced Weaponry Technology Demonstration	20712	21353	6234	17691	17830	20113	21098	20660	Continuing	Continuing

**A. Mission Description and Justification:** This project includes the non-missile stand-off weapon residuals and advanced concepts for the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) and lethality enhancements under the Direct Fire Lethality Program. Weapon demonstrations are vital to assessing new tactics and technologies for early entry forces to defeat armor. Collectively, weapons under RFPI constitute stand-off killer options for a "hunter/stand-off killer" approach. The Precision Guided Mortar Munition (PGMM) demonstration will feature an affordable, extended range, top-attack, high value target capability for light forces. It has included assessments of both 81mm and 120mm non-developmental item candidates and will demonstrate a 120mm PGMM. Large footprint, smart munition sensor technologies applicable to the Multiple Launch Rocket System (MLRS) will also be evaluated. Increased sensor footprints are important to provide capabilities to attack moving targets. Towed howitzer fire control enhancements applicable to both Army and Marine Corps artillery requirements are included under the RFPI ACTD. A key RFPI ACTD residual sensor, integrated acoustic system (IAS), will be fabricated. A 105mm guided projectile will be evaluated in FY1999. The 105mm terminally guided projectile (TGP) will provide the demonstration of an autonomous and laser guided projectile that will give an extended range direct support artillery capability to the light forces. Most of these concepts being demonstrated are candidates for technology insertions and most provide significant enhancement to early entry forces. A FY1997 Congressionally-mandated Extended Range Artillery projectile (XM982) program develops required technology for resolving the Army's artillery range deficit. The XM982 is a 155mm artillery cargo projectile that uses both rocket assist and base burn to achieve longer range, up to 47 kilometers with the Crusader solid propellant system. The XM982 program will demonstrate the technical feasibility and operational potential of this projectile, including accuracy enhancements afforded by an autoregistration fuze. The XM982 component technology and autoregistration fuze transitioned from applied research activities funded under PE 0602624A and PE 0602618A. In FY1996 and FY 1997 Congress also mandated applications for electro-rheological (ER) fluids for use in next generation artillery recoil mechanisms. Most of the concepts to be demonstrated are candidates for technology insertions and most provide significant enhancement to early entry forces. In FY 1999, this project will initiate integration of components and demonstrate the unmanned terrain domination concepts: area denial system and anti-personnel landmine alternatives. In-house efforts are accomplished by Armament Research Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp. (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron, Lowell, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; Olin-Flinchbaugh, Red Lion, PA; Textron, Inc., Willington, MA; Technical Solutions Incorporated (TSI), Mesina Park, NM; Motorola, Scottsdale, AZ; Lockheed Martin, Sunnyvale, CA; MEI Technology, Lexington, MA; Computing Device International, Minneapolis, MN; Singer Kearfott, Wayne, NJ; Diehl GmbH., Rotherbach, Germany.

Project D43A

Page 5 of 9 Pages

Exhibit R-2 (PE 0603004A)

350

Item 30

UNCLASSIFIED

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603004A Weapons and Munitions Advanced Technology	D43A	
FY 1996 Accomplishments:			
• 9412	- Continued contractor effort for PGMM subsystem integration and testing; conducted hi-g testing of seeker, guidance and control and projectile structural components; conducted 120mm PGMM projectile extended range glide test out to eight km; procured mortar fire control lightweight components.		
• 921	- Demonstrated PGMM warhead lethality against earth and timber bunkers.		
• 3000	- Completed fabrication of subscale and design of full scale electro-rheological (ER) fluid recoil prototype for live fire demonstration.		
• 5538	- Initiated liquid propellant testing to evaluate oscillation reduction techniques; initiated tests of ignition flow visualization and material compatibility.		
	- Completed AIS-Damocles captive carry test against real time critical targets and incorporated target models for RFPI Advanced Concept Technology Demonstration (ACTD) testing.		
• 1841	- Procured digitized fire control components for testing integration onto 155mm towed howitzer.		
	- Successfully completed spin testing and ballistic structural integrity testing of the advanced XM982 155mm projectile design incorporating a larger, two-piece, rocket grain, scalloped carrier and dual output fuze.		
Total	20712		
FY 1997 Planned Program:			
• 10142	- Conduct 105/120mm common tactical seeker captive flight test (CFT); complete integration of seeker and air frame and conduct 'high g' test; develop software for mortar fire control ballistic computer and fire control simulator; modify PGMM system hardware-in-the-loop.		
	- Fabricate and test towed howitzer fire control units for RFPI ACTD training.		
	- Procure towed howitzer fire control lab system for RFPI system integration.		
	- Test and integrate fire control hardware and software for 155mm automated howitzer.		
• 10714	- Conduct XM982 extended range artillery risk reduction testing (range precision, expulsion, dual function fuze, wind tunnel)		
	- Conduct electro-rheological (ER) fluid recoil test fire and refinements.		
	- Conduct AIS-Damocles captive carry test against RFPI targets and participate in RFPI ACTD simulation as an advanced concept.		
• 497	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs		
Total	21353		
FY 1998 Planned Program:			
• 4301	- Complete projectile integration; initiate PGMM experiments for RFPI ACTD (extended flight demo, telemetry demo).		
• 1933	- Conduct field experiment for the 155mm automated howitzer with XVIII Airborne Corps.		
	- Develop tactics, techniques and procedures (TTPs) for the 155mm automated howitzer.		
	- Upgrade one battery with digitized fire control system (DFCS); conduct RFPI field experiment.		
	- Residual hardware fabrication (partial) for RFPI ACTD.		
Total	6234		
Project D43A		Page 6 of 9 Pages	
		Exhibit R-2 (PE 0603004A)	

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603004A Weapons and Munitions Advanced Technology

D43A

## FY 1999 Planned Program:

- 10118 - Design detailed terminally guided projectile (TGP) and test TGP subsystem performance.
- Support towed howitzer and IAS RFPI extended user evaluation residual effort.
- Initiate fabrication of prototype area denial system hardware.
- Complete PGMM RFPI ACTD experiments (i.e., CFT, extended flight demo, telemetry demo) and producibility evaluation.
- 7051 - Fabricate hardware and demonstrate on dynamic simulator, a tank turret/drive system with reduced stabilization error.
- 522 - Initiate medium caliber ammunition enhancements for defeat of future light armored threat.
- Total 17691

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	18763	11809	9862	20263
Appropriated Value	19290	21353		
Adjustments to Appropriated Value	+1422			
FY 1998 Pres Bud Request	20712	21353	6234	17691

## Change Summary Explanation:

Funding: FY 1996 funds increased (+1949) for liquid propellant technology effort.

FY 1997 funds increased (+2000) for Damocles, (+5000) for XM982 extended range projectile and (+3000) for ER fluids efforts.

FY 1998 funds reprogrammed (-3628) to higher priority requirements.

FY 1999 funds reprogrammed (-2572) to higher priority requirements.

Project D43A

Page 7 of 9 Pages

Exhibit R-2 (PE 0603004A)

352

Item 30

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603004A Weapons and Munitions Advanced Technology								D232	
COST (in Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D232	Advanced Munitions Demonstration	4980	5652	12021	11544	14524	16881	16738	15880	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> The direct fire lethality program will enhance tank kinetic energy (KE) penetrator lethality, particularly against explosively reactive armor (ERA) appliqué arrays, through use of a precursor defeat mechanism. The program will demonstrate range and lethality enhancements for tank munitions and demonstrate the emerging technologies needed to defeat the active protection system (APS) threat. In the near term, this project demonstrates advanced warhead and cartridge concepts, utilizing novel explosively formed penetrators (EFP) and shaped charged designs, that can be applied to product improvements to fielded and developmental anti-armor munitions, e.g., autonomous intelligent submunition (AIS-Damocles), wide area munitions (WAM), smart target activated fire and forget (STAFF), 120mm chemical energy (CE) cartridge and The Army Combined Arms Weapons System (TACAWS). It advances warhead technology to enhance the lethality of smart projectiles by providing multi-role, multi-effect warheads capable of defeating point and area targets. This project will fund demonstrations of advanced fuzes for near term munitions concepts. Low Cost Competent Munition (LCCM) concepts integrating global positioning system (GPS), fuzing, and possibly guidance and control (G&amp;C) technology are being developed for artillery projectiles. The resulting screw-on module will significantly increase a projectile's overall delivery accuracy and also be readily applicable to the existing stockpile of 155mm artillery projectiles. In-house efforts are accomplished by Armament Research Development and Engineering Center, Picatinny Arsenal, NJ and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Major contractors include: Alliant Tech Systems, Minneapolis, MN; Science Applications International Corp. (SAIC), McLean, VA; LTV Aerospace, Dallas, TX; Textron Defense Systems, Wilmington, MA; Ferrulmatic, Inc., Totowa, NJ; Talley Defense, Mesa, AZ; Parker Kinetics Design, Austin, TX; Nomura Enterprise, Rock Island, IL; Loral, Dallas, TX; and Olin-Flinchbaugh, Red Lion, PA.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>2503 - Demonstrated 25% increase in armor penetration in a top attack submunition type warhead.</li> <li>2477 - Completed integrated kinetic energy precursor penetrator design.</li> <li>- Formulated concept for an advanced dual EFP liner warhead for STAFF lethality upgrade to defeat advanced armors.</li> </ul> <p>Total 4980</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5524 - Conduct defeat of explosive reactive armor (ERA) proof of principle demonstration with KE precursor.</li> <li>- Design/develop enhanced STAFF dual-liner EFP warhead and conduct function demonstrations.</li> <li>- Fabricate prototype LCCM auto-registration system for FY1998 flight testing; refine and test GPS translator components.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs</li> </ul> <p>Total 5652</p>											

Project D232

Page 8 of 9 Pages

Exhibit R-2 (PE 0603004A)

353

Item 30

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603004A Weapons and Munitions Advanced

D232

## Technology

## FY 1998 Planned Program:

- 11537 - Complete KE defeat of ERA integrated cartridge design; initiate fabrication of demonstration hardware.
- Optimize design of dual-liner EFP warhead and complete functional demonstrations.
- Complete full-up system demonstration of LCCM auto-registration system; complete Milestone I; transition to engineering and manufacturing development (EMD).
- 484 - Initiate design of an optimized main charge and a candidate precursor warhead to defeat APS.

Total 12021

## FY 1999 Planned Program:

- 11544 - Conduct advanced KE cartridge technology maturation demonstrations and performance demonstration of ERA defeat.
- Initiate 3 year system demo of 2-D/3-D LCCM self-correcting concept.
- Demonstrate a tactical long standoff warhead to defeat APS by defeating range targets in a realistic atmosphere.

Total 11544

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

5100

5242

-262

4980

FY 1997

5772

5652

5652

FY 1998

12047

12021

FY 1999

11574

11544

Project D232

Page 9 of 9 Pages

Exhibit R-2 (PE 0603004A)

354

Item 30

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY											
PE NUMBER AND TITLE											
3 - Advanced Technology Development											
0603005A Combat Vehicle and Automotive											
Advanced Technology											
COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	26363	28811	32885	59573	65140	65677	55464	70590	Continuing	Continuing	
DC62 TRACTOR UNION	0	3198	18616	26401	17424	12288	0	0	0	77927	
D221 Combat Vehicle Survivability	11353	4659	690	690	1633	958	10954	13850	Continuing	Continuing	
D440 Advanced Combat Vehicle Technology	11527	13101	4256	20325	34162	38310	23258	31104	Continuing	Continuing	
D441 Combat Vehicle Mobility Technology	2516	4115	2949	4816	3350	4700	10500	12673	Continuing	Continuing	
D497 Combat Vehicle Electronics	967	1780	6174	7341	8571	9421	10752	12963	Continuing	Continuing	
D502 HAECC II	0	1958	0	0	0	0	0	0	0	1958	

**Mission Description and Budget Item Justification:** This program demonstrates the feasibility and operational potential of technologies which contribute to upgrades of fielded combat vehicles and more advanced ground combat vehicle systems. It places emphasis on solutions to post-Cold War deficiencies, providing opportunities for more affordable, deployable, survivable, horizontally integrated and lethal power projection capabilities than are currently available. The technology areas supported by this program element include: survivability, mobility, digital intra-vehicular electronics, and integration of diverse vehicle technologies developed by the Army, other DoD laboratories and industry. Initiatives conducted under this program element that support land combat on the horizontal battlefield include the introduction of: composite materials to reduce the weight of ground vehicle components, vehicle structures and armor; integrated survivability to increase survivability with less weight burden than ballistic armor and better capabilities against smart or precision guided munitions; combat vehicle performance enhancements and crew size reduction through automation of crew functions and optimized crew/vehicle integration; advanced mobility technologies to improve agility, propulsion system size and weight reduction; and lower operation and support costs by implementation of a low cost, non-developmental advanced combat vehicle electronics and a standards based electronics architecture with digitized vehicle sub-systems. Work in this program element is consistent with the Army Science and Technology Master Plan, Science and Technology Objectives, Army Modernization Plan, and the Ground and Sea Vehicle Defense Technology Area Plan (DTAP). This program is managed primarily by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC). This program adheres to Tri-Service Reliance Agreements on advanced materials, fuels and lubricants, and ground vehicles, with oversight and coordination provided by the Joint Directors of Laboratories. Work in this program element is related to and fully coordinated with PE 0602601A (Combat Vehicle and Automotive Technology) and contains no unwarranted duplication of effort among the Military Departments. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603005A Combat Vehicle and Automotive

D221

## Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D221 Combat Vehicle Survivability	11353	4659	690	690	1633	958	10954	13850	Continuing	Continuing

**A. Mission Description and Justification:** This project demonstrates near term, advanced technologies for horizontal protection against smart, precision guided and other munitions threats to ground combat vehicles. A front end battlefield operational effectiveness analysis (Project Guardian) identified the highest payoff sensors and countermeasures to focus the Hit Avoidance (HA) Advanced Technology Demonstration (ATD). The HA ATD will be completed in FY97 with emphasis on the rapid transfer of survivability technologies to current systems (i.e., Abrams tank and Bradley fighting vehicle). The ATDs will demonstrate technical feasibility and develop system specifications for a low cost, active protection system for the physical disruption of non-gun tube fired, horizontal attack, hit-to-kill, chemical energy (CE) threat munitions and transfer hardware/software of a commander's decision aid (CDA) to engineering development for current systems. The CDA will provide the "brains" to interpret and fuse sensor input data, select and activate appropriate countermeasures, manage expendable inventory and increase situational awareness. This project will also develop and field tested a Congressionally directed vehicle self-protection system capable of close-in detection of high velocity, low front end radar cross-section kinetic energy (KE) threat munitions. This project will provide hardware performance and modeling predictions for a cost effective, operationally optimal suite of threat sensors and countermeasure devices. Coupled with other combat vehicles assets, force protection and increased situational awareness capabilities could then be realized. This enhanced vehicle survivability will extend the fighting life of the vehicle and result in a force multiplying effect and greater life cycle savings for the vehicle fleet. Survivability technologies that are integrated and demonstrated under this project include those transitioned from the following exploratory developmental programs; active protection countermeasure technology development PE 0601102A (Defense Research Sciences)/ Project AH43 and BH57; sensors and countermeasures PE 0602270A (Electronic Warfare Technology)/ Project A442. This project also supports a classified program. Major contractors include: United Defense LP. of San Jose (prime), CA; Sanders, a Lockheed Martin Company in Nashua, NH.; TRW of Redondo Beach, CA.; Dynetics, Inc. in Huntsville, AL.; Hughes Danbury, Danbury Conn.; Chang Industries, LaVerne, CA.

## FY 1996 Accomplishments:

- 4717 - Optimized design and initiated fabrication of low cost active protection concept for protection against smart, horizontal attack, chemical energy (CE) threat munitions based on component field test evaluations of radar sensor, countermeasure options, and countermeasure launcher.
- Awarded a competitive contract for the development, testing and analysis of an armored vehicle self-protection system capable of close in detection and destruction of high velocity, low front-end radar cross section KE rounds as directed by Congress.
- Completed the development and acquisition of sensor and countermeasure emulators for the evaluation of the CDA.
- 3666 - Developed and integrated sensor fusion algorithms for threat identification and location into a commander's decision aid for automation of crew responses.
- Performed cost effectiveness analysis to determine optimal survivability suite approach for the ground combat vehicle fleet through joint User evaluation.
- 2970 - Classified program support.
- Total 11353

Project D221

Page 2 of 12 Pages

Exhibit R-2 (PE 0603005A)

356

Item 31

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603005A Combat Vehicle and Automotive Advanced Technology</b>	<b>D221</b>																										
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>4003 - Perform field demonstration of a low cost active protection system to defeat non-gun tube fired, horizontal attack, hit-to-kill, chemical energy (CE) threat munitions, develop system specifications for this system and field test a self-protection system capable of close in detection of high velocity, low front-end radar cross-section kinetic energy (KE) threat munitions.</li> <li>- Demonstrate the commander's decision aid and provide system specifications (including software in standard ADA code and necessary documentation for engineering and manufacturing development (EMD) application).</li> <li>- Update operational effectiveness analysis to complete affordability assessment with validated threat sensor and countermeasure performance data.</li> <li>- Transfer the CDA to PEO Ground Combat and Support Systems (GCSS) for engineering and manufacturing development (EMD).</li> <li>559 - Classified program support.</li> <li>97 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> <li>Total 4659</li> </ul> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>690 - Classified program support.</li> <li>Total 690</li> </ul> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>690 - Classified program support.</li> <li>Total 690</li> </ul> <p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 97 President's Budget</td> <td>12090</td> <td>4758</td> <td>678</td> <td>675</td> </tr> <tr> <td>Appropriated Value</td> <td>12429</td> <td>4659</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-1076</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>11353</td> <td>4659</td> <td>690</td> <td>690</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 97 President's Budget	12090	4758	678	675	Appropriated Value	12429	4659			Adjustments to Appropriated Value	-1076				FY 1998 Pres Bud Request	11353	4659	690	690
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 97 President's Budget	12090	4758	678	675																								
Appropriated Value	12429	4659																										
Adjustments to Appropriated Value	-1076																											
FY 1998 Pres Bud Request	11353	4659	690	690																								

Project D221

Page 3 of 12 Pages

Exhibit R-2 (PE 0603005A)

357

Item 31

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

0603005A Combat Vehicle and Automotive  
Advanced Technology

PROJECT

D440

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D440 Advanced Combat Vehicle Technology	11527	13101	4256	20325	34162	38310	23258	31104	Continuing	Continuing

**A. Mission Description and Justification:** This project demonstrates the operational potential, technical feasibility and maturity of advanced combat vehicle technologies for potential product improvements to currently fielded and next generation combat vehicles. The objectives are to demonstrate innovative combat vehicle configurations, technologies and integration techniques through Integrated Product and Process Development (IPPD) yielding hardware technology demonstrations, computer simulations and full-scale demonstrations, to accomplish a more rapid and seamless transition of advanced technologies to systems applications. All demonstrations include user and developer teaming in field and/or laboratory environments. This project concludes a major initiative, the Composite Armor Vehicle (CAV) ATD, which examines technologies applicable to lighter weight and more survivable systems that offer significantly improved deployability over currently fielded combat vehicles. The CAV ATD will demonstrate a vehicle structure made of composite materials with advanced lightweight armor technology which can significantly reduce weight while improving survivability. The CAV program acknowledges that any issues, such as automotive durability, ability to withstand weapon firing shock, manufacturing methods and technology, reparability, ballistic performance, and nondestructive testing, must be resolved before composite technology can be transitioned to ground combat vehicle systems. Coordination with ground vehicle program managers (PMs) has resulted in active interest by PM Crusader in transitioning composite technology into the Crusader design. The Future Scout and Cavalry System (FSCS) ATD is another major initiative that transitions from applied research PE 0602601A (Combat Vehicle and Automotive Technology) to this project in FY98. This program will integrate advanced technologies, including sensors, signature management, survivability, advanced mobility technologies and communications in the selected scout platform. The FSCS ATD will then undergo technical and user evaluations. Potential exists for a joint program on the FSCS program and the United Kingdom's TRACER program. Other vehicles supported by this PE with advanced component concepts and technologies include Abrams tank upgrades, the M2/M3 Bradley and Crusader. United Defense, Limited Partnership, San Jose, CA is the prime contractor for the CAV ATD.

## FY 1996 Accomplishments:

- 10799 - Approved CAV final design; using advanced composite manufacturing techniques, fabricated one composite hull structure for the CAV ATD test vehicle.
- Demonstrated and validated the composite hull interfaces of the CAV ATD hull sample sections for automotive, crew, and weapon station subsystems.
- Using CAV composite technology, developed a turret design for the Crusader vehicle to enable composite material transition..
- Performed a Battle Lab Warfighting Experiment (BLWE) with soldiers to verify battlefield reparability of composites.
- 728 - Integrated the scout sensor suite on surrogate Hunter vehicle and conducted automotive testing.
- Total 11527

Project D440

Page 4 of 12 Pages

Exhibit R-2 (PE 0603005A)

358

Item 31

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603005A Combat Vehicle and Automotive  
Advanced Technology

D440

## FY 1997 Planned Program:

- 9507 - Assemble all automotive components into composite hull to complete the CAV ATD test vehicle.
- Initiate and complete large caliber weapon firing test to confirm hull structural integrity during gun firing.
- Initiate and complete automotive performance test to validate the capability of the hull structure to perform over various terrains and obstacles.
- Fabricate second composite hull structure for ballistic and durability testing.
- 3330 - Initiate 6000 mile durability test to validate the capability of the CAV structure to withstand combat vehicle life cycle fatigue loads and determine the structure's reliability.
- Initiate and complete a composite design guide for use by combat vehicle designers.
- Develop and release FSCS ATD request for proposal.
- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- 264
- Total 13101

## FY 1998 Planned Program:

- 1500 - Complete CAV 6000 mile durability testing, final report and close contract.
- 2756 - Develop concepts and analysis in support of the Training and Doctrine Command (TRADOC) Integrated Concept Team (ICT) FSCS requirements development and transition results to the winning contractors.
- - Evaluate proposals and award contract for FSCS ATD.
- Contractor will develop and allocate FSCS ATD design tradeoffs down to subsystems and initiate FSCS preliminary design.
- Total 4256

## FY 1999 Planned Program:

- 7577 - Transition vehicle electronics (VETRONICS) open systems architecture (VOSA) to the FSCS ATD contractor(s).
- - Implementation of VOSA into the FSCS ATD design by the contractor(s).
- - Initiate development of electronic interfaces between major subsystems of FSCS (e.g., target acquisition, communication, crew control and displays, etc.) by contractor(s).
- 12748 - Complete contractor(s) preliminary design and interface control for FSCS ATD effort and initiate detail design.
- Contractor(s) develop manufacturing concepts, vehicle concepts and tools for engineering models for the FSCS ATD.
- Contractor(s) incorporate sensor suite, crew station, and electronic interface into contractor(s) design/systems integration laboratory (SIL) for FSCS ATD.
- Contractor(s) initiate development of FSCS ATD hardware and software.
- Total 20325

Project D440

Page 5 of 12 Pages

Exhibit R-2 (PE 0603005A)

359

Item 31

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
3 - Advanced Technology Development	0603005A Combat Vehicle and Automotive Advanced Technology		D440
<b>B. Project Change Summary</b>			
FY 97 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	11777	13507	2757
Adjustments to Appropriated Value	12109	13101	
FY 1998 Pres Bud Request	-582		
	11527	13101	4256
			20325
Change Summary Explanation: Funding: FY 1998 Funding increased (+1499) to complete testing of Composite Armored Vehicle.			

Project D440

Page 6 of 12 Pages

Exhibit R-2 (PE 0603005A)

Item 31

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE								
BUDGET ACTIVITY		PROJECT								
3 - Advanced Technology Development		D441								
PE NUMBER AND TITLE		0603005A Combat Vehicle and Automotive Advanced Technology								
COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D441 Combat Vehicle Mobility Technology	2516	4115	2949	4816	3350	4700	10500	12673	Continuing	Continuing

**A. Mission Description and Justification:** This project demonstrates mobility technologies (suspension, track, engines, transmissions, and auxiliaries) vital for lighter, more agile, more deployable ground combat vehicles. It funds an advanced mobility technology demonstration comprised of several independent demonstrations. The principal elements of the mobility demonstration are semi-active suspension, electric drive, and light weight track. Military requirements for vehicle mobility are unique because of (1) a need for a stable, smooth ride at high speeds (greater than 20 mph) over rough, cross country terrain, (2) a need for the mobility components to be as small and as light as possible in order not to detract from the vehicle's primary, war-fighting mission, and (3) a need for armor and signature management, which complicate the engine air intake and exhaust systems. High speed is required to accomplish the maneuver-dominant warfare envisioned in the Air-Land battle doctrine. A smooth ride is necessary for weapon targeting on the move and for crew comfort and endurance, which are features embedded in the doctrine. The lighter and smaller vehicles are necessary for enhancing deployability and lessening the logistics burden (fuel), but such vehicles will significantly degrade ride performance and mobility limits compared to larger, heavier vehicles without new mobility technology advances. For the next decade, the mobility thrusts required to compensate for smaller and lighter systems are: electric drive (small internal propulsion size and weight), active suspension (increased vehicle stability and higher speed on rough terrain), compact efficient transmissions and light weight track (reduced system weight and track noise). Electric drive offers unique new capabilities, such as high torque and quiet operation; however, it presents new challenges, especially in cooling of electronic components. In-house efforts are accomplished by the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI and the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground, MD. Other government agencies include: Waterways Experiment Station, Vicksburg, MS; Army Research Laboratory, Adelphi MD. Major contractors include: General Dynamics Land Systems Muskegon Operations, Muskegon, MI; Pentastar Huntsville, AL; United Defense Limited Partnership, San Jose, CA; Michigan Technological University, Houghton MI; General Electric, Schenectady, NY; Cadillac Gage Textron, New Orleans, LA.

**FY 1996 Accomplishments:**

- 1205 - Initiated joint cooperative program (Army, USMC, DARPA) for integrated electric drive for tracked combat vehicles.
  - Procured semi-active suspension 30 ton weight class combat vehicle.
  - Developed single wheel HMMWV suspension test rig for control evaluation.
- 1311 - Performed experimental evaluation on advanced band track configurations.
  - Performed an analysis of high power density propulsion packaging for heavy combat vehicles.
  - Conducted mobility analysis of vehicle concepts that have electric drive, advanced suspension, and advanced track components.

Total 2516

Project D441

Page 7 of 12 Pages

Exhibit R-2 (PE 0603005A)

361

Item 31

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603005A Combat Vehicle and Automotive

D441

## Advanced Technology

## FY 1997 Planned Program:

- 1563 - Evaluate cooling systems for electric drive electronics.
- Test 30 ton weight class combat vehicle semi-active suspension in test vehicle.
- 1085 - Evaluate band track system application at increased vehicle weight.
- Analyze and compare study results of high power density propulsion system concepts for heavy combat vehicles.
- 1400 - In coordination with DARPA, demonstrate 30 ton weight class combat vehicle electric drive system.
- Develop compact high efficiency mechanical transmission
- 67 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 4115

## FY 1998 Planned Program:

- 1128 - In coordination with DARPA, test and evaluate electric drive and advanced mobility components on a 30 ton test bed.
- 1821 - Develop and evaluate active suspension preview sensor and algorithms.
- Develop track tensioning system for Future Scout and Cavalry System application.
- Develop semiactive suspension for Future Scout and Cavalry System.
- Test compact high efficiency mechanical transmission

Total 2949

## FY 1999 Planned Program:

- 2800 - Demonstrate band track system on 22 ton weight class combat vehicle.
- Demonstrate track and suspension system for Future Scout and Cavalry System
- 2016 - Test and evaluate silicon carbide (SiC)-based power electronic switches for motor drive controllers.
- Develop active suspension system using advanced subsystem technology.

Total 4816

## B. Project Change Summary

FY 97 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

2565

2637

-121

2516

FY 1997

4203

4115

4115

FY 1998

3821

2949

FY 1999

4818

4816

Change Summary Explanation: Funding: FY 1998- Funding reprogrammed (-872) to higher priority requirements.

Project D441

Page 8 of 12 Pages

Exhibit R-2 (PE 0603005A)

362

Item 31

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603005A Combat Vehicle and Automotive								D497	
		Advanced Technology									
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D497	Combat Vehicle Electronics	967	1780	6174	7341	8571	9421	10752	12963	Continuing	Continuing

**A. Mission Description and Justification:** This project develops and demonstrates the digital electronic technologies required to integrate advanced computing architectures and control data/power distribution within ground combat vehicles. This project is essential to achieve horizontal technology integration on the digitized battlefield. This project also funds improvements in ground vehicle soldier machine interfaces (SMI) by designing advanced crew station configurations for current combat vehicle upgrades and advanced vehicle designs with a 50% crew workload reduction. This project leverages technologies developed under the Crewman's Associate ATD for preliminary design of a FSCS crewstation and systems upgrades to Abrams, Bradley, and other ground combat vehicles. Laboratory experiments are used to allow the user to continuously influence and evaluate the capabilities of the crew station design and to refine overall system requirements prior to building more extensive hardware prototypes and vehicles. This interactive crew station design work ensures that future crew stations are designed to optimize the interface for the warfighter, allowing him to take maximum advantage of the digitized battlefield, not be overburdened by it. This project funds the development of the next generation of VETRONICS open systems architecture (VOSA) and provides an evolvable ground vehicle architecture/software baseline that will enable continuing software reuse. This will be a nonproprietary open systems electronics integration architecture based on commercially available standards and components. It will provide an initial harmonized architecture baseline with the UK for the FSCS ATD. It will then build on the FSCS ATD architecture to provide an advanced architecture baseline for the FSCS EMD and other ground vehicle programs. This architecture improves upon the current state-of-the-art ground vehicle integration architectures providing a 50% reduction in the cost per developed source line of software code while gaining a 10X improvement in system performance per hardware module. This architecture is critical to the integration of advanced sensors and countermeasures, advanced target acquisition technologies and digital communications into modern combat vehicles and is critical to the soldier's effective use of these technologies. Both the crew station work and VOSA are required to support Program Executive Office Ground Combat and Support Systems (PEO GCSS) preplanned product improvement (P3I) opportunities for the existing fleet (e.g., Abrams, Bradley), contribute to Crusader development, and support other vehicle development programs such as the FSCS ATD and Future Combat System.

**FY 1996 Accomplishments:**

- 967 - Conducted laboratory experiments/battlelab warfighting experiments (BLWEs) to demonstrate an improved SMI for an upgrade to the Abrams tank and an advanced two-man crew station (50% workload reduction).
- Completed Crewman's Associate Final Test/Design Report; Crewman's Associate ATD completed. Advances include: A 65% decrease in the workload required to send C2 messages, improved situational awareness, improved operations on the move, a user-friendly interface to the digital battlefield of Force XXI, improved night operations, reduced maneuver damage, improved continuous operations (CONOPs).

Total 967

Project D497

Page 9 of 12 Pages

Exhibit R-2 (PE 0603005A)

Item 31

363

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603005A Combat Vehicle and Automotive

D497

## Advanced Technology

## FY 1997 Planned Program:

- 1043 - Define US/UK harmonized electronic architecture baseline for the FSCS ATD.
- Develop FSCS software architecture application program interface (API) reuse and performance baseline.
- Modify VOSA software baseline to optimize the use of the latest version of the ADA programming language (ADA 95).
- Development of hierarchy of hardware and software technical reference models to enable reuse and simplify open systems integration.
- 730 - Define US/UK harmonized FSCS crew task list.
- Define FSCS ATD crew station simulator design.
- 7 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 1780

## FY 1998 Planned Program:

- 3374 - Evaluate FSCS ATD electronics architecture concepts.
- Enhance and provide contractor 30% of the software for FSCS ATD as reuse modules.
- Demonstrate VOSA, ADA 95 optimized, software architecture in the TARDEC system integration laboratory (SIL).
- Define VOSA enhancements based on FSCS ATD contractor selections.
- 2800 - Evaluate FSCS ATD contractor crew station concepts.
- Demonstrate FSCS crew task list baseline for user evaluation.
- Provide 40% of crew station simulation software to FSCS ATDs as reuse.
- Total 6174

## FY 1999 Planned Program:

- 4206 - Optimize competing contractors FSCS ATD electronic architectures.
- Define ground vehicle domain electronics architecture.
- Define optimized electronic architecture for FSCS EMD initiation.
- Begin fabrication of a ground vehicle domain electronic architecture SIL.
- 3135 - Define optimized FSCS crew station design and simulation.
- Design FSCS crew station advanced decision aids and light weight helmet mounted display (HMD) for technology demonstration.
- Modify FSCS crew station simulator for advanced functionality demonstration and user evaluation.
- Total 7341

Project D497

Page 10 of 12 Pages

Exhibit R-2 (PE 0603005A)

364

Item 31

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603005A Combat Vehicle and Automotive Advanced Technology</b>	<b>D497</b>	
<b>B. Project Change Summary</b>			
FY 97 President's Budget		FY 1997	FY 1998
Appropriated Value		5818	6181
Adjustments to Appropriated Value		1780	
FY 1998 Pres Bud Request		1780	6174
			7341
Change Summary Explanation: Funding: FY 1997- Funding reduced by Congress (-4038) for vehicle electronics hardware and software for generic future systems.			

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603005A Combat Vehicle and Automotive

D502

## Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D502 HAECO II	0	1958	0	0	0	0	0	0	0	1958

**A. Mission Description and Budget Item Justification:** This Congressionally-directed project, originally funded in FY95 and funded again in FY97, calls for the further continued development and Army testing of the combined diesel/turbine engine program. The Army has contracted with the Hope-Anderson Engine Company (HAECO) to complete development of two engines in the 400 to 600 horsepower range for delivery to the Army for testing at the U.S. Army Tank-Automotive and Armaments Command. The contractor is HAECO Partners Ltd., Hillsboro, Ohio.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 1910 - Test two end cylinders of an eight cylinder engine to improve scavenging and optimize the division of combustion and internal cooling air flow. Once a satisfactory design is achieved, reconfigure the design and fabricate parts for the upgraded final engine configuration. Test the new multicylinder engine with the objective to demonstrate 600 horsepower.
  - 48 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 1958

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99.

**B. Project Change Summary**

	FY 1996	FY 1997	FY 1998	FY 1999
FY 97 President's Budget	0	0	0	0
Appropriated Value	0	1958		
Adjustments to Appropriated Value	0			
FY 1998 Pres Bud Request	0	1958	0	0

Change Summary Explanation: Funding: FY 1997-Funding provided by Congress (+1958) to conduct testing of the combined diesel/turbine engine program.

Project D502

Page 12 of 12 Pages

Exhibit R-2 (PE 0603005A)

366

Item 31

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

## 0603006A Command, Control and Communications Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	29323	29379	19688	20911	19328	18707	22248	22852	Continuing	Continuing
D247 Tactical C4 Technology Integration	5245	7271	8028	12824	10422	9665	12153	13023	Continuing	Continuing
D257 Digital Battlefield Communications	12224	11620	8645	5365	4768	4827	5794	5431	Continuing	Continuing
D592 Space Applications Technology	5216	3635	3015	2722	4138	4215	4301	4398	Continuing	Continuing
D596 Field Laser Radar Demo	2844	4895	0	0	0	0	0	0	0	7739
D597 Wave Net Technology	3794	1958	0	0	0	0	0	0	0	5752

**Mission Description and Budget Item Justification:** This program element consists of projects that will advance command, control, and communications (C3) technology to provide the soldier with high quality real-time battlefield information and integrate space technologies into Army tactical applications. The tactical C4 technology integration project provides software application development demonstrations, communications system integration and prototype products for distributed, mobile, secure, fully automated spread spectrum radio networks with measures to enhance the survivability, efficiency and efficacy of Army tactical command, control, communications and computer (C4) systems. This program specifically addresses joint service demonstrations coordinated through the joint directors of laboratories (JDL) technology panel for C4, and provides key demonstrations of systems integration across the Army's battlefield functional areas. Work in this PE will provide multimedia inter networked communications while on-the-move (OTM) with commercial standard gateway connectivity to both high-speed and legacy communications assets. This program also tests and evaluates net radio, common user, and distributed communications equipment and automated spectrum management aids which have potential to solve user needs; tests and evaluates equipment deficiencies; and provides critical future capabilities and supports new radio developments and evaluation, in conjunction with the Defense Advanced Research Projects Agency (DARPA) and the Air Force (AF). The Digital Battlefield Communications project will support the Army's battlefield digitization effort by demonstrating technology to integrate communications hardware and software capable of providing seamless communications for the digitized battlefield to meet emerging requirements for high-capacity/OTM information exchange and leading to a battlefield information transmission system (BITS) for Force XXI. The space applications technology project will demonstrate novel applications of space assets for Army missions and support space technology integration. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. Work in this program element is related to and fully coordinated with efforts in PE 0602782A (Command, Control and Communications Technology), PE 0203740A (Maneuver Control System), PE 0203726A (Advanced Field Artillery Tactical Data System), PE 0602783A (Computer and Software Technology), PE 0602702E (Tactical Technology), PE 0603772A

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UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE
BUDGET ACTIVITY	PE NUMBER AND TITLE	
<b>3 - Advanced Technology Development</b>	<b>0603006A Command, Control and Communications Advanced Technology</b>	<b>February 1997</b>
<p>(Advanced Tactical Computer Science and Sensor Technology), and PE 0603789F (C3I Technology Development) in accordance with the ongoing Reliance Joint planning process. Efforts under Projects D247 (Tactical C3 Technology Integration) and D257 (Digital Battlefield Communications) are performed primarily by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Space and Terrestrial Communications Directorate, Fort Monmouth, NJ. Contractors include: SRI International, Menlo Park, CA; Mitre Corporation and Boozee-Allen and Hamilton, Eatontown, NJ; AT&amp;T, Holmdel, NJ; GTE, Taunton, MA; Hazeltine, Greenlawn, NY; Rockwell International, Richardson, TX; and Jet Propulsion Laboratories, Pasadena, CA. Work under D592 (Space Applications Technology) is managed primarily by the U.S. Army Space and Strategic Defense Command (USASSDC), Alexandria, VA. Work in this program element is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is correctly placed in Budget Activity 3.</p>		

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
D247

## 3 - Advanced Technology Development

0603006A Command, Control and  
Communications Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D247 Tactical C4 Technology Integration	5245	7271	8028	12824	10422	9665	12153	13023	Continuing	Continuing

**A. Mission Description and Justification:** This project develops computer and communications technology options using commercial standard hardware and software to support battlefield decision making for the five battlefield functional areas. These efforts support evolving Army requirements for automated, real-time, digital information transfer, and the development and demonstration of communication systems needed for the combined arms command and control (CAC2) program. This project also performs development of ultra-high frequency (UHF) satellite communications (SATCOM) on-the-move (OTM), interfaces mobile UHF SATCOM radios to combat net radios (CNR) technology using commercial standard packet data protocols, and is developing multiband, multimode radio (MBMMR) technologies as part of the Joint Service "Speakeasy" program with the Air Force and the Defense Advanced Research Projects Agency (DARPA).

**FY 1996 Accomplishments:**

- 2490 - Developed direct broadcast system capability as part of a joint program to demonstrate the potential applications for using the technology with standard Ku-band satellites and ground segments.
- Investigated the feasibility and benefits of a terrestrial personal communications systems (PCS) by demonstrating the capability with legacy systems, mobile subscriber equipment for Task Force XXI.
- Developed and demonstrated surrogate digital radio (SDR) technology during TF XXI to determine the effectiveness of passing high-volume digital traffic through a network in a battlefield situation.
- Demonstrated internet protocol (IP) tactical end to end encryption devices (TEED), in support of field exercises.
- Demonstrated autonomous battlefield satellite PCS capability.
- Integrated ATM into legacy communication systems.
- 2755 - Continued development of Speakeasy Phase 2 MBMMR engineering prototypes and test modifications to software/hardware for adequate emulation of waveforms.

Total 5245

**FY 1997 Planned Program:**

- 4364 - Develop and demonstrate on-the-move surrogate direct broadcast satellite (DBS) capability that will provide DBS-like capability to areas and situations without regard to satellite access limitations for both stationary and moving platforms.
- Develop technology options for military use of commercial personal communication systems (PCS) technology for wireless access into the Army's mobile subscriber equipment (MSE).
- Conduct field tests of the wideband packet surrogate digital radio in the task force (TF) XXI advanced warfighting experiment (AWE).

Project D247

Page 3 of 14 Pages

Exhibit R-2 (PE 0603006A)

369

Item 32

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

## 0603006A Command, Control and Communications Advanced Technology

D247

## FY 1997 Planned Program (continued)

- Conduct communication experiments with other services over the defense information systems network (DISN)/ leading edge services (LES) interconnection.
- Develop an initial prototype of a conformlal phased array antenna for radio access point communications on-the-move requirements.
- Develop and demonstrate legacy modifications to allow legacy SATCOM terminals to use CECOM's airborne relay as a surrogate satellite to overcome limitations of satellite availability for tactical users.
- 2750 - Continue the Speakeasy development of an open system architecture for a software reprogrammable simultaneous four-channel multiband multimode radio (MBMMR) which allows rapid change over of wave forms, frequency bands (2-2000 MHz), internetworking protocols (cross channel), voice/data modes, and information security (INFOSEC) algorithms, leading to an Army demonstration in a tactical vehicle configuration.
- 157 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs
- Total 7271

## FY 1998 Planned Program:

- 2850 - Perform a field demonstration of the year-2 Advanced Development Model (ADM) Speakeasy Multiband Multimode Radio. Complete design, software coding, and fabrication on year-3 ADMs to reduce size, weight, power consumption and increase functionality.
- 3000 - Continue lab experimentation with the other Services by exercising the Defense Information Systems Network (DISN)/Leading Edge Service (LES) interconnection to evaluate interconnection of tactical ATM with fixed ATM.
- Complete development of an integrated phased array antenna for radio access point communications OTM requirements.
- 2178 Integrate and demonstrate end-to-end SHF surrogate satellite capability for range extension. Begin SATCOM terminal enhancements to reduce size and weight increasing throughput and mobility. Start UAV-based battlefield paging development.
- Total 8028

## FY 1999 Planned Program:

- 3350 - Complete the Speakeasy development of an open system architecture for a software-reprogrammable simultaneous four-channel multiband multi-waveform which allows rapid changeover of waveforms, frequency bands (2-2000 Mhz), inter-networking protocols (cross-channel), voice/data modes, and INFOSEC algorithms (four-channel). Demonstrate radio in a tactical vehicle configuration.
- 2820 - Continue DISN/LES interconnection experiments to evaluate emerging multi-service communication architectures.
- Demonstrate appropriate digital battlefield communications (DBC) advanced technology demonstration (ATD) technologies in CORPS XXI AWE in support of high-capacity digitized communications and split-based operations. Demonstrate all the DBC ATD technologies in joint warfighter interoperability demonstration (JWID) 99.
- 2350 - Demonstrate integrated phased array antenna for radio access point communications on-the-move (OTM) requirements.

Project D247

Page 4 of 14 Pages

Exhibit R-2 (PE 0603006A)

370

Item 32

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603006A Command, Control and Communications Advanced Technology</b>	<b>D247</b>																										
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>4304 - Demonstrate UAV-based battlefield paging. Complete and demonstrate SHF SATCOM terminal enhancements. Fully integrate and demonstrate end-to-end UAV based surrogate satellite capability.</li> </ul> <p>Total 12824</p>																												
<p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>5362</td> <td>7427</td> <td>8043</td> <td>12862</td> </tr> <tr> <td>Appropriated Value</td> <td>5570</td> <td>7271</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-325</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>5245</td> <td>7271</td> <td>8028</td> <td>12824</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	5362	7427	8043	12862	Appropriated Value	5570	7271			Adjustments to Appropriated Value	-325				FY 1998 Pres Bud Request	5245	7271	8028	12824
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Project D247

Page 5 of 14 Pages

Exhibit R-2 (PE 0603006A)

371

Item 32

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

## 0603006A Command, Control and Communications Advanced Technology

D257

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D257 Digital Battlefield Communications	12224	11620	8645	5365	4768	4827	5794	5431	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is to integrate communications hardware and software capable of providing seamless, multimedia communications for the digitized battlefield, designed to meet emerging requirements for high capacity, on-the-move (OTM) information exchange. Force projection and evolving doctrine are expected to require significantly more communications bandwidth, drastically altered traffic patterns, new services (e.g. imagery), and higher mobility, especially at echelons brigade and below, than is currently supported by today's communications systems. This project will develop and demonstrate a series of products, through an evolutionary process, capable of transitioning into field units to support the future digitized brigade, division and corps. The project will build on early system performance models begun under the combined arms command and control (CAC2) program, in order to identify appropriate non-developmental wideband communications systems to supplement the data capacity of existing lower echelon networks. Once data "hot spots" and congestion points are identified in the existing architecture, warfighter demonstrations will be used to demonstrate the warfighter benefit of added capacity at key locations on the digitized battlefield, and to identify and size fieldable deployment packages consisting of wideband digital communications and support devices to supplement existing tactical communications systems. Technology demonstration units of wide-bandwidth digital radios will be required. Laboratory demonstrations and protocol development to permit asynchronous transfer mode (ATM) traffic to interface with tactical radio/satellite equipment will be conducted. A mobile radio access point (RAP) consisting of a high capacity, OTM trunk radio, powerful portable switch (ATM or other) and legacy wide bandwidth digital subscriber networks will be developed and evaluated by troops in the field. The RAP will provide a high bandwidth OTM trunk feed in support of combat net radio, single channel radio access (SCRA), and wideband data subscribers, all communicating OTM. Network planning tools and dynamic internetwork management schemes will be exploited for both pre-battle communications planning and dynamic reconfiguration during deployment. Development of OTM antennas begun in prior years will be extended to provide fieldable, low profile antennas better suited to OTM wideband needs to connect forward mobile elements in split based deployments. Wideband airborne communications relays will be developed and evaluated for warfighter utility in achieving range extension at high data rates. Commercial personal communication systems (PCS) and direct broadcast satellite (DBS) will be evaluated for possible tactical exploitation.

## FY 1996 Accomplishments:

- 2615 - Began integration of ATM service into legacy communications network.
- 1912 - Completed functional definition of RAP.
- 2690 - Determined emerging satellite technologies that will be required to use the tactical multi-net gateway (TMG) as an interface into the Tactical Internet as described in the Tactical Internetwork System Description.
- 2690 - Completed commercial off the shelf (COTS) testing/requirements definition for high capacity trunk radio (HCTR).
- Began analysis of criteria imposed by the supported ground segment (HCTR/RAP antenna) and available platforms.
- Continued modeling and simulation of battlefield information transmission system (BITS) technologies.
- Completed demonstration of low profile OTM antennas.

Project D257

Page 6 of 14 Pages

Exhibit R-2 (PE 0603006A)

372

Item 32

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603006A Command, Control and Communications Advanced Technology	D257	
FY 1996 Accomplishments: (continued)			
•	3007	<ul style="list-style-type: none"><li>- Began experimentation with wideband airborne communications relays and satellite personal communications services (PCS).</li><li>- Demonstrated direct broadcast video for tactical applications.</li><li>- Integrated field models of the surrogate digital radio (SDR) into a brigade in conjunction with the task force (TF) XXI advanced warfighting experiment (AWE).</li><li>- Implemented TEED into Digital Battlefield Communications architecture to provide security technology for multi level security (MLS) requirements.</li><li>- Evaluated hardware in the Digital Integrated Laboratory (DIL) to ready for TF XXI exercise.</li><li>- Inserted and integrated emerging communications technologies in TF XXI. Provided technical/engineering support and on-site field support for TF XXI encompassing necessary coordination of AWE systems.</li></ul>	
•	2000		
Total	12224		
FY 1997 Planned Program:			
•	2850	<ul style="list-style-type: none"><li>- Demonstrate military-unique ATM enhancements (i.e. adaptive forward error correction, ATM signaling over tactical circuits, ATM over wireless networks) over legacy communication systems (e.g. mobile subscriber equipment (MSE)) to allow for better use of available bandwidth. Support and conduct TF XXI AWE ATM multimedia experimentation.</li><li>- Develop and demonstrate wireless subscriber access (e.g. commercial PCS, wireless ISDN, near term data radio, SDR) into the RAP.</li><li>- Leverage commercial personal communications system (PCS) technology to create a terrestrial PCS that will use very small tactical transportable base stations enabling wireless access into MSE (tactical MSE interface to commercial standard hardware).</li><li>- Continue experimentation of communications satellite PCS technology to determine responsiveness to Army needs.</li><li>- Demonstrate radio access point (RAP) function, integrating mobile internet protocol, and survivable hand-off capability in a multi media laboratory demo using commercial standard (e.g. ATM, IP, narrowband integrated service digital network (ISDN) ) protocols.</li><li>- Begin modification of commercial non developmental hardware for high capacity trunk radio (HCTR) demonstration.</li><li>- Continue modeling and simulation support for RAP/HCTR development.</li><li>- Demonstrate a wideband, point to point 45 mega bits per second (MBps) airborne communications relay package to link RAP/HCTR back to MSE/tri-service tactical communications system (TRITAC)/Army common user system (ACUS).</li><li>- Develop an initial prototype of a conformal phased array antenna for radio access point communications on-the-move requirements.</li><li>- Conduct user tests of DBC ATD products in TF XXI AWE and other user demonstrations.</li><li>- Conduct experimentation of the wideband packet surrogate digital radio (SDR) in the TF XXI AWE.</li><li>- Continue experimentation and support of tactical end-to-end encryption device security requirements for the DBC ATD and TF XXI.</li><li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li></ul>	
•	3230		
•	3817		
•	1439		
•	284		
Total	11620		
Project D257		Exhibit R-2 (PE 0603006A)	
		Page 7 of 14 Pages	

UNCLASSIFIED



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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603006A Command, Control and Communications Advanced Technology	D257	
FY 1998 Planned Program:			
• 1785	- Complete ATM multimedia experimentation. Demonstrate ATM/MSE voice, low rate survivable ATM protocols, adaptive forward error correction (FEC), and support for ATM signaling in a tactical environment.		
	- Complete evaluation and demonstrate commercial terrestrial PCS to exploit commercial technology for MSE access. Begin PCS range extension enhancement.		
• 2856	- Integrate the RAP prototype into the digital integrated laboratory to demonstrate connectivity with MSE TPN and enhanced position location reporting system (EPLRS) in a static environment.		
	- Integrate Real Time Internet Protocol (IP) with mobile IP for TMG/ATM to support RAP with low bit rate video teleconferencing.		
• 2450	- Complete modification of commercial off the shelf (COTS) NDI hardware for high capacity trunk radio integration and demonstration.		
	- Initiate development of a dual band (X-band and Ku-band) airborne communications relay package capable of supporting 155 Mbps communications.		
	- Complete development of an integrated phased array antenna for RAP communications on-the-move requirements.		
• 1554	- Insert and evaluate DBC ATD products in DIV XXI AWE and other user demonstrations.		
	- Continue experimentation and support of tactical end-to-end encryption device (TEED) security requirements for the DBC ATD.		
	- Complete modeling and simulation tools for BITS product development.		
	- Begin DIL experimentation with Near Term Digital Radio (NTDR) in a ground field environment.		
	- Demonstrate narrowband high frequency communications technology with tactical internet access.		
Total	8645		
FY 1999 Planned Program:			
• 1153	- Demonstrate ATM enhancements for high bandwidth trunks, such as survivable tactical ATM routing and virtual circuit identifier/ virtual path identifier (VCI/VPI) control, and provide support for mobile high bandwidth ATM networks.		
	- Demonstrate ATM integration into RAP.		
• 1870	- Demonstrate mobile Radio Access Point (RAP). Integrate and demonstrate RAP with OTM HCTR and phased array antenna capable of mobile operation.		
• 1040	- Integrate on-the-move (OTM) High Capacity Trunk Radio (HCTR) in the RAP.		
	- Complete DIL evaluation of the NTDR.		
• 1302	- Demonstrate a dual band (X-band and Ku-band) airborne communications relay package capable of supporting 155-Mbps communications.		
	- Demonstrate mobile phased array antenna and PCS range extension enhancement.		
	- Insert and evaluate DBC ATD products in JWID 99 and other user demonstrations.		
FY 1999 Planned Program: (continued)			
	- Complete support of TEED security requirements for the DBC ATD.		
Project D257			
		Exhibit R-2 (PE 0603006A)	

Page 8 of 14 Pages

374

Item 32

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
3 - Advanced Technology Development		0603006A Command, Control and Communications Advanced Technology	D257
<p>- Demonstrate wideband high frequency communications technology, with access to the tactical internet, for transmitting maneuver and intelligence data beyond line of sight for long range surveillance units.</p>			
Total	5365		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget		FY 1996	FY 1997
Appropriated Value		10579	11981
Adjustments to Appropriated Value		10854	11620
FY 1998 Pres Bud Request		1370	
		12224	11620
			8645
			5365
<p>Change Summary Explanation: Funding: FY1996- Funding increase in project (+1645) reflects increased support for TF XXI AWE.</p>			

Project D257

Page 9 of 14 Pages

Exhibit R-2 (PE 0603006A)

375

Item 32

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603006A Command, Control and

D592

## Communications Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D592 Space Applications Technology	5216	3635	3015	2722	4138	4215	4301	4398	Continuing	Continuing

**A. Mission Description and Justification:** The objective of this project is to optimize Army utilization of space based systems. The project involves: (a) space technology development and demonstrations for evaluating technology feasibility, determining Army utility, and refining requirements, and (b) space technology integration into Battlefield Operating Systems. The project also addresses: defining Army requirements for space platforms; demonstrating advanced, compact space hardware; developing algorithms that optimally process space data; integrating satellite direct downlink to ground systems; and providing an advanced technology base for the Army Space Exploitation Demonstration Program, the Tri-Service DoD Space Test Program, and the exploitation of commercial space capabilities. The project focus is on Space Force Enhancement (communications, intelligence, position/navigation, reconnaissance, surveillance, target acquisition, weather/terrain, missile warning) to improve warfighting capabilities and operations other than war.

**FY 1996 Accomplishments:**

- 5216 - Demonstrated the solid-state laser boresight calibration system for space-based infrared (IR) sensors.
- Developed and tested the Acousto-Optical Tunable Filter (AOTF) IR sensor to provide multi/hyperspectral data from a space-based platform.
- Conducted feasibility study of alternative laser communication satellite-to-air-to-ground architectures.
- Completed study of utilizing planned commercial communication satellite systems to meet the Army's mobile communication requirements.

Total 5216

**FY 1997 Planned Program:**

- 1095 - Demonstrate laser boresight calibration for space-based infrared (IR) sensors to improve joint tactical ground station (JTAGS) performance.
- 710 - Develop low-altitude/high data rate laser communication ground terminal and conduct air-to-ground (mobile and fixed) lasercom demonstration.
- 665 - Complete field test and demonstrate AOTF utility to provide spectral data from airborne platform.
- 1080 - Develop Battlefield Ordnance Awareness plan, acquire target data, and evaluate C4I architecture.
- 85 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3635

Project D592

Page 10 of 14 Pages

Exhibit R-2 (PE 0603006A)

376

Item 32

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603006A Command, Control and Communications Advanced Technology</b>	<b>D592</b>																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 500 - Integrate laser boresight calibration capability into JTAGS system to include self-alignment and pointing.</li> <li>• 365 - Develop Ultraspectral Sensor technology for satellite and direct downlink applications.</li> <li>• 1150 - Demonstrate Battlefield Ordnance Awareness Concept on airborne platforms.</li> <li>• 1000 - Demonstrate satellite-to-ground laser communication.</li> </ul> <p>Total 3015</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 500 - Demonstrate and integrate satellite-to-satellite laser communications.</li> <li>• 1200 - Demonstrate the ability of the Battlefield Ordnance Awareness technology to identify explosive ordnance events on the battlefield and specify levels of conflict.</li> <li>• 1022 - Exploit commercial space products and capabilities that will enhance deep strike weapon systems, reduce sensor to shooter timelines, and improve the spatial registration of battlefield intelligence and targeting information.</li> </ul> <p>Total 2722</p> <p><b>B. Project Change Summary</b></p> <table> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>2947</td> <td>3712</td> <td>2512</td> <td>2215</td> </tr> <tr> <td>Appropriated Value</td> <td>5498</td> <td>3635</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-282</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>5216</td> <td>3635</td> <td>3015</td> <td>2722</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1996- Funding (+2269k) increased by Congress for development and demonstration of missile warning, target acquisition and communications advanced space technologies.  FY 1998/FY 1999 - Funding increased for the integration of missile warning and communications advanced space technologies into Battlefield Operating Systems.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	2947	3712	2512	2215	Appropriated Value	5498	3635			Adjustments to Appropriated Value	-282				FY 1998 Pres Bud Request	5216	3635	3015	2722
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	2947	3712	2512	2215																								
Appropriated Value	5498	3635																										
Adjustments to Appropriated Value	-282																											
FY 1998 Pres Bud Request	5216	3635	3015	2722																								

Project D592

Page 11 of 14 Pages

Exhibit R-2 (PE 0603006A)

377

Item 32

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603006A Command, Control and

D596

## Communications Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D596 Field Laser Radar Demo	2844	4895	0	0	0	0	0	0	0	7739

**A. Mission Description and Justification:** The objective of this Congressional special interest project is to provide data reduction and analysis of field experiments data to evaluate the utility of the Field Laser Radar for Army applications. The Field Laser Radar is an imaging carbon dioxide (CO2) laser radar (ladar). This ladar transmits a waveform capable of high resolution measurements in both range and velocity. Potential applications to be investigated include theater ballistic missile defense or cruise missile defense. In addition, the equipment can provide long range, coherent remote sensing of chemical warfare agents.

## FY 1996 Accomplishments:

- 690 -Conducted chemical warfare agent detection experiments.
- Conducted static ground tests on cruise missiles.
- Conducted flight tests of unpowered tactical air launched decoy.
- 2154 -Developed algorithms and analyzed field data.
- Analyzed helicopter installation requirements.
- Developed hardware requirements for helicopter ladar.

Total

2844

## FY 1997 Planned Program:

- 1150 -Conduct chemical warfare agent detection experiments.
- Conduct static ground tests on cruise missiles.
- Conduct flight tests of unpowered tactical air launched decoy.
- 3625 -Develop date products fusion and algorithms.
- Analyze precision and active angle tracking.
- Develop multi-dimensional image.
- 120 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

4895

FY 1998 Planned Program: Program not funded in FY 98.

FY 1999 Planned Program: Program not funded in FY 99.

Project D596

Page 12 of 14 Pages

Exhibit R-2 (PE 0603006A)

378

Item 32

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
3 - Advanced Technology Development	0603006A Command, Control and Communications Advanced Technology	D596																										
<p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>2918</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Appropriated Value</td> <td>3000</td> <td>4895</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-156</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>2844</td> <td>4895</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1997- Funding provided by Congress (+4895k) to test the current hardware in a tactical environment</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	2918	0	0	0	Appropriated Value	3000	4895			Adjustments to Appropriated Value	-156				FY 1998 Pres Bud Request	2844	4895	0	0
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	2918	0	0	0																								
Appropriated Value	3000	4895																										
Adjustments to Appropriated Value	-156																											
FY 1998 Pres Bud Request	2844	4895	0	0																								

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603006A Command, Control and

D597

## Communications Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D597 Wave Net Technology	3794	1958	0	0	0	0	0	0	0	5752

**A. Mission Description and Justification:** The objective of this Congressional special interest project is to develop and evaluate a Wave Net circuit to perform image compression and decompression. Wave Net is an application-specific integrated circuit that utilizes a neural network architecture to efficiently perform low loss image compression. Potential applications include compression of imagery for battlefield situation awareness, aerial surveillance sensor downlinks, and image based target hand-off.

**FY 1996 Accomplishments:**

- 3794 - Performed simulations to verify throughput, fidelity, and error resiliency of the Wave Net architecture. Initiated development and testing of prototype Wave Net circuit card.

Total 3794

**FY 1997 Planned Program:**

- 1910 - Complete development and testing of prototype wave net circuit card to investigate the potential of the algorithms to increase communications bandwidth utilization.
- 48 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1958

**FY 1998 Planned Program:** Project not funded in FY 98.**FY 1999 Planned Program:** Project not funded in FY 99.**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
3794	0	0	0
4000	1958		
-206			
3794	1958	0	0

Change Summary Explanation: Funding: FY 1997 funding provided by Congress (+1958) to develop and evaluate a Wave Net circuit to perform image compression and decompression.

Project D597

Page 14 of 14 Pages

Exhibit R-2 (PE 0603006A)

380

Item 32

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE									
3 - Advanced Technology Development		0603007A Manpower, Personnel and Training Advanced Technology									
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		4576	4406	3003	3006	3001	2996	2991	2991	Continuing	Continuing
A792 Manpower and Personnel		2148	1389	3003	3006	3001	2996	2991	2991	Continuing	Continuing
A793 Training Systems and Education		2428	3017	0	0	0	0	0	0	0	5445

**Mission Description and Budget Item Justification:** The objective of this program is to demonstrate soldier-oriented technologies to enhance soldier and unit performance. Affordability goals include the reduction of personnel costs through improved career development and retention and the development of effective training strategies within a constrained resource environment. Research programs include developing knowledge and skills required for successful command on the increasingly digitized battlefield, training strategies using simulators and in distributed interactive simulation (DIS), and developing improved career progression procedures to meet the requirements of the 21st Century battlefield. Work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, and Project Reliance. These projects are dedicated to conducting proof of principal field demonstrations and tests of technologies to meet specific military needs and are therefore correctly placed in Budget Activity 3. This PE is managed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). As a result of the HQDA Redesign, ARI's research program has undergone major restructuring.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

0603007A Manpower, Personnel and Training

Advanced Technology

PROJECT

A792

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A792 Manpower and Personnel	2148	1389	3003	3006	3001	2996	2991	2991	Continuing	Continuing

**A. Mission Description and Justification:** This project demonstrates soldier-oriented technologies that will lead to improved Army personnel utilization. A major focus of the project is on the human leader and decision maker in evolving digitized, battle command systems. The research will also demonstrate new methods for identifying high quality male and female enlistees, for assigning them to Military Occupational Specialties (MOS) that maximize total force readiness, and for retaining the most effective performers. It also develops and demonstrates behavioral science-based methods to achieve optimized design of Army decision-making staff organizations. Other efforts will develop innovative, simulation-based methods for career-long leader development to ensure that today's lieutenants and captains develop adequate knowledge and skills to become tomorrow's Division commanders for the digitized battlefield. This program supports the Manpower and Personnel Defense Technology Area. Work in this program element is coordinated with the Training and Doctrine Command (TRADOC) Battle Laboratories, and demonstration projects are integrated into the Battle Labs' Advanced Warfighting Experiments. Beginning FY98, this project will include training research.

## FY 1996 Accomplishments:

- 2148 - Developed improved soldier-job matching procedures by effectively utilizing psychomotor, spatial and temperament measures.
- Refined Special Forces selection and assignment tests and procedures.
- Provided preliminary findings on determinants of battle command performance and recommendations for decision aid evaluation methodologies to the Battle Command Battle Lab.
- Developed methods for improving occupational analysis efficiency and accuracy.
- Validated prototype techniques for developing and training practical thinking skills within tactical units.
- Determined the relationship between individual soldier characteristics and performance in peacekeeping missions.

Total 2148

## FY 1997 Planned Program:

- 1355 - Provide guidelines for harnessing available and projected information technologies to support effective battle command on the future digitized battlefield.
- Demonstrate utility of Battle Commander development tools and techniques.
- Develop peer and supervisory ratings of Special Forces leadership potential.
- Provide findings on the post-deployment effects of peacekeeping on soldier and spouse marital stability, financial well-being, and commitment to the Army (active and reserves).
- 34 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1389

Project A792

Page 2 of 5 Pages

Exhibit R-2 (PE 0603007A)

382

Item 33

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603007A Manpower, Personnel and Training Advanced Technology</b>	<b>A792</b>	
<b>FY 1998 Planned Program:</b>			
• 3003	- Assess effectiveness of compressed gunnery training strategies for Army National Guard. - Provide information for update of Battalion Level Training Models based on research and development of structured training programs for the Close Combat Tactical Trainer (CCTT). - Develop and demonstrate improved methods for writing training objectives and translating them into efficient exercise scenarios for joint fire support training.		
Total 3003			
<b>FY 1999 Planned Program:</b>			
• 3006	- Develop and demonstrate methods for planning and conducting systematic, vertical (multi-site, multi-Service, multi-echelon) after-action reviews for joint exercises in DIS (distributed interactive simulation). - Assess effectiveness of prototype MOUT (military operations in urban terrain) training developed for rifle squad leaders in Dismounted Battlespace Battle Lab warfighting experiments. - Develop and pre-test scenarios and role plays designed to help leaders assess, train, and develop team members of the Special Operations Forces.		
Total 3006			
<b>B. Project Change Summary</b>			
FY 1997 President's Budget Appropriated Value	FY 1996	FY 1997	FY 1998
Adjustments to Appropriated Value	2204	1418	2035
FY 1998 Pres Bud Request	2265	1389	2482
	-117		
	2148	1389	3003
			3006
Change Summary Explanation: Funding: Funds reprogrammed in FY1998 (+968) and FY1999 (+524) for restructure of training research to this project.			

Project A792

Page 3 of 5 Pages

Exhibit R-2 (PE 0603007A)

383

Item 33

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE		February 1997						
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT						
3 - Advanced Technology Development		0603007A Manpower, Personnel and Training		A793						
		Advanced Technology								
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
A793 Training Systems and Education	2428	3017	0	0	0	0	0	0	0	5445
<p><b>A. Mission Description and Justification:</b> The objective of this project is to demonstrate empirically-based cost-effective training strategies, with particular emphasis on how to best use distributed interactive simulation (DIS) training environments. This program is predicated on research showing that the effectiveness of training aids, devices, simulations, and simulators (TADSS) is largely a function of how they are used in training, including the adequacy of performance measurement techniques and performance feedback methods. Training strategies will be developed to integrate all three types of simulation (live, virtual and constructive) into a seamless training environment that will enhance training quality, relevancy and efficiency for warfighting missions and for stability operations. This research supports the TRADOC Battle Labs and will utilize emerging Battlefield Distributed Simulation-Developmental (BDS-D) capabilities. This program supports the Training Systems Defense Technology Area. Beginning in FY1998, this research is restructured to project A792.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2428 - Developed device-based tool for predicting tank gunnery performance for Reserve Component (RC).</li> <li>- Validated prototype structured platoon-level training program for Close Combat Tactical Trainer (CCTT).</li> <li>- Developed database for relating training performance in SIMNET to performance at the Combat Training Centers.</li> <li>- Identified infantry unit training problems caused by transition from combat roles to peacekeeping/stability missions and back.</li> <li>- Designed a preliminary aviation training strategy with an emphasis on low-cost, part-task simulators and training devices.</li> <li>- Demonstrated the feasibility of natural language processing and authoritative microworlds in computer-based language training for Arabic.</li> </ul> <p>Total 2428</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2943 - Validate brigade-level and multi-service training strategies and performance assessment methodologies.</li> <li>- Deliver recommendations for the frequency and sequencing of training for Combined Arms Tactical Trainer training management system.</li> <li>- Design prototype, structured company-level CCTT training program.</li> <li>- Design and test prototype aviation training strategies with alternative mixes of training devices/simulators/simulations and live training.</li> <li>- Develop RC training device-based tool (AFIST) for predicting live-fire tank gunnery performance.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>74 Total 3017</p> <p><b>FY 1998 Planned Program:</b> Program restructured to project A792.</p> <p>Project A793</p>										

Exhibit R-2 (PE 0603007A)

Page 4 of 5 Pages

384

Item 33

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
3 - Advanced Technology Development	0603007A Manpower, Personnel and Training Advanced Technology	A793																										
<p>FY 1999 Planned Program: Program restructured to project A792.</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>2492</td> <td>3082</td> <td>3242</td> <td>3764</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2561</td> <td>3017</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-133</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2428</td> <td>3017</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: As a result of ARI restructuring, training research is reported in Project A792 beginning in FY1998.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	2492	3082	3242	3764	Adjustments to Appropriated Value	2561	3017			FY 1998 Pres Bud Request	-133					2428	3017	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	2492	3082	3242	3764																								
Adjustments to Appropriated Value	2561	3017																										
FY 1998 Pres Bud Request	-133																											
	2428	3017	0	0																								

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603105A Military Human Immunodeficiency Virus (HIV) Research

DH29

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DH29 Medical Protection Against HIV	2795	17544	2713	3162	3182	3157	3208	3381	Continuing	Continuing

**A. Mission Description and Budget Item Justification:** This program element supports research to provide concept exploration of candidate prevention vaccines to include safety and efficacy in model systems to prepare and conduct clinical studies. It funds Congressionally directed Acquired Immune Deficiency Syndrome (AIDS) research to control the infection in military environments, to protect the military blood supply and to protect military personnel from unusual risks associated with infection. AIDS research is focused on the following thrust areas: diagnosis; natural history; epidemiology; and vaccine development. Efforts are directed to answer militarily unique questions affecting manning, mobilization and deployment. This program is managed primarily by the US Army Medical Research and Materiel Command. The major contractor is Henry M. Jackson Foundation for the Advancement of Military Medicine, Rockville, MD. This program is dedicated to conducting proof of principle demonstrations and tests of non-system specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

## FY 1996 Accomplishments:

- 1873 Characterized field sites for clinical trials of candidate vaccines.
- 922 Evaluated safety and immunogenicity Phase I and Phase II of candidate vaccine.
- Total 2795

## FY 1997 Planned Program:

- 1894 Continue field site preparation for candidate vaccine clinical trials.
- 954 Complete safety and immunogenicity Phase I and Phase II trials of multiple candidate vaccines.
- 7134 Congressional special interest. Conduct studies to develop a vaccine to prevent HIV including: characterize protective epitopes, evaluate vaccine candidates in animal models, identify cohorts for vaccine trials, develop and maintain international and domestic laboratories to support HIV trials, and assess the feasibility of a killed whole virus vaccine.
- 1617 Congressional special interest. Conduct national and international surveillance of HIV genotypes and select the most promising strains for vaccine development.
- 5516 Congressional special interest. Conduct studies on HIV specific immune reconstitution, natural history of HIV infection, role of cell receptors in infectivity and pathogenicity, and preliminary studies on rapid diagnosis of HIV infection.
- 429 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 17544

Project DH29

Page 1 of 2 Pages

Exhibit R-2 (PE 0603105A)

386

Item 34

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
3 - Advanced Technology Development	0603105A Military Human Immunodeficiency Virus (HIV) Research	DH29																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1153 Prepare field site for candidate vaccine clinical trials.</li> <li>• 858 Conduct safety and immunogenicity Phase I and Phase II trials of promising candidate vaccines.</li> <li>• 702 Analyze possible correlates of immunity of vaccines and controls that participated in these trials.</li> </ul> <p>Total 2713</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1352 Conduct field site preparation for candidate vaccine clinical trials.</li> <li>• 1009 Complete safety and immunogenicity Phase I and Phase II trials of candidate vaccines.</li> <li>• 801 Examine possible immune responses from these vaccine trials.</li> </ul> <p>Total 3162</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>2866</td> <td>2919</td> <td>3047</td> <td>3207</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>2946</td> <td>17544</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-151</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2795</td> <td>17544</td> <td>2713</td> <td>3162</td> </tr> </table> <p>Change Summary Explanation:</p> <p>Funding: FY1997: Funding (14625) provided by Congressional action.</p> <p>FY 1998: Funds reprogrammed (-334) to higher priority programs.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	2866	2919	3047	3207	Adjustments to Appropriated Value	2946	17544			FY 1998 Pres Bud Request	-151					2795	17544	2713	3162
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	2866	2919	3047	3207																								
Adjustments to Appropriated Value	2946	17544																										
FY 1998 Pres Bud Request	-151																											
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Project DH29

Page 2 of 2 Pages

Exhibit R-2 (PE 0603105A)

387

Item 34

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603238A Air Defense/Precision Strike Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	37630	22009	11664	4926	18798	18029	17971	15819	Continuing	Continuing
D177 JT ALS PS Demo	33624	13997	6066	1473	18798	18029	17971	15819	Continuing	Continuing
D546 STARLOS	4006	8012	5598	3453	0	0	0	0	0	21069

**Mission Description and Budget Item Justification:** Overall Joint Precision Strike Demonstration (JPSD) program goals are to reduce sensor to shooter timelines from hours to minutes as well as to achieve quantifiable improvements in target location and identification, weapons systems responsiveness and kill capability, and accurate damage assessment through such techniques as near-real-time sensor cueing, near-real-time data dissemination, seamless sensor-to-shooter node communication, dynamic re-targeting, improved weapons system accuracy and precision guided munitions. This program provides for the integration of new, high-payoff technologies, architectural and operational concepts, along with existing and emerging systems to demonstrate enhanced precision strike and counterfire capabilities for targets at deep and extended ranges. The objective of the Joint Precision Strike Demonstration (JPSD) Precision/Rapid Counter Multiple Rocket Launcher (P/RC-MRL) Advanced Concept Technology Demonstration (ACTD) is to address the operational need to locate, identify, and kill high-value, time-critical targets and to assess damage within tactically meaningful timelines. To address this objective, the program conducts building block demonstrations to identify technical and operational barriers to an adverse weather, day/night, end-to-end sensor-to-shooter precision strike capability and to demonstrate and experiment with potential solutions to these barriers. The FY96/97 demonstration was conducted in Korea and successfully demonstrated an enhanced capability to defeat the 240mm MRL threat and provided the Commander-in-Chief, United States Forces Korea (CINCSFK), tactical "leave behind" enhanced capabilities. Leave behind products will continue to be fielded and supported in FY97/98. This program element also funds development activities for a high resolution Synthetic Aperture Radar Target Recognition and Location System (STARLOS) with real time Aided Target Recognition (ATR). The work in this program element is closely coordinated with the Joint Staff; other services, the Army's combat development community, TRADOC Battle Labs, and appropriate materiel developers to conduct field demonstrations and experiments to assess specific technologies for military needs and is therefore placed in Budget Activity 3. Work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan, Project Reliance, and the Joint Warfare Science and Technology Plan. The work also supports Force XXI and the Army Warfighting Experiments (AWEs).

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603238A Air Defense/Precision Strike Technology								D177	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D177	JT ALS PS Demo	33624	13997	6066	1473	18798	18029	17971	15819	Continuing	Continuing

**A. Mission Description and Justification:** The Joint Air Land Sea Precision Strike Demonstration project conducts a series of building block demonstrations to identify barriers to an advanced precision strike capability and to assess candidate solutions to these barriers. In FY95 the Precision/Rapid Counter-Multiple Rocket Launcher (P/RC-MRL) Advanced Concept Technology Demonstration (ACTD) program was initiated and a Continental United States (CONUS) ACTD demonstration was successfully conducted as a first step towards accomplishing the objective Outside CONUS (OCONUS) ACTD demonstration in FY96/97. The successful FY95/96 demonstration underscored the validity of the JPSSD approach in countering the MRL threat and more accurately depicted the value added by each of the leave-behind systems. The OCONUS demonstration was conducted in Korea in September and October 1996. It successfully exhibited an enhanced capability to find, track and defeat the 240mm MRL threat. Delivery and support of leave behind capabilities began in FY96 and will continue during FY 97/98. Leave behind capabilities include: connectivity between the Korean Combat Operations Information Center and the 2nd Infantry Division; enhancements to the Firefinder radar system; automation for the 2nd Infantry Division Main Command Post; Automated Weapon Target Pairing software for artillery battalions; enhancements of Army connectivity to Air Force and Navy command and control; and Aided Target Recognition capability for the Tactical Endurance Synthetic Radar (TESAR) sensor that flies on Predator. Additionally, two years of in-country follow-on support will provide a residual operational capability to immediately improve the ability of CINC U. S. Forces Korea/Combined Forces Command (USFK/CFC) to defeat the 240mm MRL threat. Later work efforts include application of P/RC-MRL ACTD products and lessons learned to a joint follow-on effort as well as assessing applications to other Army/Joint Precision strike requirements. Initial planning for the Survivable Armed Reconnaissance on the Digital Battlefield (SARDB) ACTD took place in FY96. Following Congressional disapproval of funds for SARDB for FY 97, funding for this program in FY 98/99 was reprogrammed to other DoD requirements. Efforts in this PE are managed by the Director, Joint Precision Strike Demonstration, Program Executive Officer, Intelligence and Electronic Warfare (PEO-I EW), Ft. Belvoir, VA. The prime contractor is Raytheon, Bedford, MA.

**FY 1996 Accomplishments:**

- 10190 - Enhanced surveillance, target acquisition, strike planning and Army and joint weapons delivery assets.
- - Formulated the SARDB ACTD program and conducted pre-ACTD activities.
- - Prepared and staffed a draft SARDB ACTD Implementation Directive and Management Plan.
- 17915 - Developed, fabricated and evaluated 2nd Generation Forward Looking Infrared Radar/Line Scan (FLIR/LS) and integrated into a surrogate Unmanned Aerial Vehicle (UAV) airframe.
- - Developed and implemented software changes for the Firefinder system to significantly enhance its capabilities.
- - Planned, trained for and initiated execution of the OCONUS portion of the Precision/Rapid Counter MRL ACTD with USFK, 2nd ID (M), TRADOC Battle Labs and the Air Force and Navy.
- - Participated in DARPA, Medium/High Altitude Endurance and Synthetic Theater of War programs.

Project D177

Page 2 of 6 Pages

Exhibit R-2 (PE 0603238A)

389

Item 35

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603238A Air Defense/Precision Strike

D177

## Technology

## FY 1996 Accomplishments: (continued)

- 4836 - Developed the multimode communications connectivities and architecture of the Integration and Evaluation Center (IEC) to support the OCONUS demo and Army AWEs. Integrated models/simulations needed for OCONUS demo.
- 683 - Completed the FY 95/96 P/RC-MRL CONUS demonstration, gathered data and conducted detailed analysis.
- Conducted initial planning for the Rapid Terrain Visualization (RTV), formerly the Rapid Battlefield Visualization, ACTD, which is separately funded in PE 0603734A (Military Engineering Advanced Technology)/Project DT12 beginning in FY97.

Total 33624

## FY 1997 Planned Program:

- 8000 - Complete the P/RC-MRL ACTD OCONUS demonstration.
- Acquire enhanced surveillance, target acquisition, strike planning and Army and Joint command and control assets.
- Evaluate potential use of 2nd Gen FLIR/LS on the Predator UAV and other tactical platforms.
- Assess potential application of P/RC-MRL ACTD products to other USFK Precision Strike requirements.
- 5658 - Prepare and distribute a comprehensive report on the FY96/97 ACTD OCONUS demonstration.
- Expand and upgrade technical capabilities of the IEC to support rapid acquisition process, operational planning for real world contingency operations and participation in Army/Joint war game activities and other technical assessments.
- Develop and implement transition plan for the P/RC-MRL ACTD leave behind systems. Provide logistics, maintenance and training support for P/RC-MRL leave behind systems.
- 339 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 13997

## FY 1998 Planned Program:

- 6066 - Complete the transition of P/RC-MRL ACTD leave behinds to CINC USFK.
- Continue leave behind systems support for the P/RC-MRL ACTD.
- Develop and publish a comprehensive P/RC-MRL ACTD report.
- Continue assessment of P/RC-MRL products to other Army/Joint Precision Strike requirements.
- Continue technical growth, as required, of IEC capabilities.

Total 6066

Project D177

Page 3 of 6 Pages

Exhibit R-2 (PE 0603238A)

390

Item 35

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																	
3 - Advanced Technology Development	0603238A Air Defense/Precision Strike Technology	D177																	
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1473 - Initiate detailed planning and approval process for a Joint follow-on effort to P/RC-MRL, supporting CINC USFK/CFC.</li> </ul> <p>Total 1473</p>																			
<p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>33624</td> <td>32046</td> <td>23198</td> <td>22659</td> </tr> <tr> <td>33624</td> <td>13997</td> <td></td> <td></td> </tr> <tr> <td>33624</td> <td>13997</td> <td>6066</td> <td>1473</td> </tr> </tbody> </table> <p>Appropriated Value</p> <p>Adjustments to Appropriated Value</p> <p>FY 1998 Pres Bud Request</p>				FY 1996	FY 1997	FY 1998	FY 1999	33624	32046	23198	22659	33624	13997			33624	13997	6066	1473
FY 1996	FY 1997	FY 1998	FY 1999																
33624	32046	23198	22659																
33624	13997																		
33624	13997	6066	1473																
<p>Change Summary Explanation: Funding: FY97 reduction (-17600) by Congress for SARDDB program. FY98/99 reductions (-17000 and -21000, respectively) deleted remaining SARDDB funding.</p>																			

Project D177

Page 4 of 6 Pages

Exhibit R-2 (PE 0603238A)

391

Item 35

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE  
February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603238A Air Defense/Precision Strike

D546

## Technology

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D546 STARLOS	4006	8012	5598	3453	0	0	0	0	0	21069

**A. Mission Description and Justification:** A technology program to demonstrate the feasibility of locating and identifying high value targets from an Army designated aerial platform. The focus of the program is on Aided Target Recognition (ATR) of short range ballistic missiles, surface-to-air missile launchers, rocket launchers and aided target cueing (ATC) of military targets of interest. The targets are located and identified by means of a high resolution synthetic aperture radar (SAR) with a real-time ATR system. The program has become a major component of the Joint Precision Strike Demonstration (JPSD) program and was the impetus for the development by industry of a high resolution SAR for onboard the Joint Chiefs of Staff (JCS) medium altitude endurance (MAE) class of unmanned aerial vehicle (UAV). The program delivers an interim ATR solution in FY97 and a final ATR solution in FY98 for installation into the Predator UAV ground control station (GCS) as an enhancement to the JPSD Precision/Rapid Counter-MRL ACTD. This program is managed by Program Executive Officer-Intelligence and Electronic Warfare, PM Tactical Endurance Synthetic Aperture Radar, with matrix support from Army Research Laboratory, Adelphi, MD and Night Vision and Electronic Sensors Directorate, CECOM RDEC, Fort Monmouth, NJ.

## FY 1996 Accomplishments:

- 2855 - Evaluated industry/government SAR ATR/ATC algorithms for planned FY97 procurement of commercial-off-the-shelf (COTS) hardware and algorithms of SAR ATR/ATC.
- Initiated procurement of a completely COTS SAR ATR/ATC processor.
- Developed ATR/ATC capability for target cueing, rapid target insertion efforts, and definition of SAR ATR/ATC requirement with the user through the use of user mini-experiments.
- Completed integration of a multi-sensor testbed (MSTB) for on board demonstration of real time SAR ATR/ATC.
- 1151 - Participated in JTF-1 exercise with 525th MI Bde and Enhanced Tactical Radar Correlator (ETRAC) with the PM TESAR-developed SAR and the Army Mobile Test Facility (MTF).
- Participated in JPSD Sensor/ATR demo at Fort A.P. Hill.
- Procured and integrated MAE UAV SAR in support of JPSD P/RC-MRL ACTD.

Total 4006

## FY 1997 Planned Program:

- 4830 - Integrate and install aided target recognition (ATR) algorithms and hardware upgrades into the Predator Ground Station for the JPSD P/RC MRL ACTD interim leave behind.
- Participate in MAE/UAV STARLOS integration demonstration for P/RC MRL ACTD and other demonstrations and experiments with the multi-sensor testbed (MSTB).

Project D546

Page 5 of 6 Pages

Exhibit R-2 (PE 0603238A)

392

Item 35

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
D546

## 3 - Advanced Technology Development

0603238A Air Defense/Precision Strike  
Technology

## FY 1997 Planned Program: (continued)

- Incorporate selected DARPA research and development technology to include interactive ATR, image registration, and object level change detection in support of the Bosnia mission with the Predator UAV.
- 2990 - Conduct data collect for the Korean targets of interest using the MSTB.
- Demonstrate real-time ATR capability of SAR using COTS hardware and demonstrate cross cueing of SAR and MTI in the MSTB.
- 192 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 8012

## FY 1998 Planned Program:

- 1198 - Complete and test ATR algorithm upgrade for 240mm MRL target.
- Incorporate ATR algorithm and false alarm mitigation techniques in UAV Ground Control Station (GCS).
- 2200 - Integrate UAV GCS hardware upgrade for ATR with existing GCS system.
- Test and demonstrate the P/RC-MRL ACTD final leave-behind.
- 1600 - Perform data collection using MSTB for expanded target set for Korean and Bosnia scenarios.
- 600 - Refine enhanced SAR ATR algorithms and demonstrate capabilities.
- Total 5598

## FY 1999 Planned Program:

- 1000 - Demonstrate end-to-end advanced SAR/ATR capability via multi-sensor testbed.
- 2000 - Incorporate enhanced SAR ATR algorithms and expanded target set into processor hardware.
- 453 - Finalize technical/logistic support for P/RC-MRL ACTD.
- Total 3453

## B. Project Change Summary

	FY 1996	FY 1997	FY 1998	FY 1999
FY 1997 President's Budget	4106	8212	5867	3853
Appropriated Value	4220	8012		
Adjustments to Appropriated Value	-214			
FY 1998 President's Budget	4006	8012	5598	3453

Change Summary Explanation: Funding: FY99 - Funds reprogrammed (-400) to higher priority requirements.

Project D546

Page 6 of 6 Pages

Exhibit R-2 (PE 0603238A)

393

Item 35

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603270A Electronic Warfare (EW) Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	3818	6651	8182	11754	18064	17831	15729	17486	Continuing	Continuing
DK15 Advanced Communications Electronics Countermeasures Demonstration	2809	2852	2883	3121	8526	7435	8228	9254	Continuing	Continuing
DK16 Non-Communications Electronics Countermeasures Technology Demonstration	1009	3799	5299	8633	9538	10396	7501	8232	Continuing	Continuing

**Mission Description and Budget Item Justification:** This program element funds two projects that provide technology options for current and future electronic warfare (EW) systems. The Advanced Communications Electronics Countermeasures Demonstration (DK15) provides technology demonstrations in communications countermeasures (CM) and information collection and reporting for transition to Army intelligence and electronic warfare (IEW) systems through the block improvement process. The effective use of specific components, software and hardware for multiple applications will enable the Army to collect intelligence from modern modulation threat electronic systems in order to disrupt their operation, denying the enemy use of their command, control and communication (C3) assets. This project also supports demonstrations of automatic fusion of intelligence data from multiple sources. Non-Communications Electronics Countermeasures Technology Demonstration (DK16) demonstrates the feasibility and effectiveness of non-communications electronic warfare hardware and software countermeasures and electronic support/electronic intelligence (ES/ELINT) for self protection from radar, electro-optical, and infrared guided anti-aircraft artillery, surface-to-air missiles, artillery, and top attack weapons, and provides precise targeting information on non-communications emitters. Area protection technology from radar threats is also developed. Work in these projects will lead to technology applications which will significantly contribute to winning the battlefield information war by controlling the electromagnetic spectrum. Work in this program element (PE) supports the multispectral countermeasures advanced technology demonstration, and provides component technology for the hit avoidance technology demonstration. Work in this program element adheres to tri-service Reliance agreements on electronic warfare. Work in this program element is related to and fully coordinated with efforts in PE 0602270A (Electronic Warfare Technology), and various Navy and Air Force program elements in accordance with the on-going Reliance joint planning process. Navy developments are conducted in PEs 0604755N (Ship Self Defense), 0204575N (Electronic Warfare Support), and 0604573N (Shipboard Electronic Warfare Improvements). Air Force developments are conducted in PEs 0604738F (Protective Systems), 0604793F (Tactical Protective Systems) and 0604710F (Reconnaissance Electronics Warfare Systems). Coordination is effected between the Services and Defense Advanced Research Projects Agency (DARPA) to eliminate duplication of effort and ensure the interchange of technical data. This program is managed primarily by Communications-Electronics Command Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. It is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

Page 1 of 5 Pages

Exhibit R-2 (PE 0603270A)

394

Item 36

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603270A Electronic Warfare (EW) Technology								DK15	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK15	Advanced Communications Electronics Countermeasures Demonstration	2809	2852	2883	3121	8526	7435	8228	9254	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project demonstrates communication countermeasures technology for the Army to use to exploit, corrupt or destroy an adversary's information system while preserving the integrity of one's own systems during critical periods of tactical transmission. It emphasizes specific components, hardware and software necessary to perform technology demonstrations which will lead to providing flexible systems with the capability of disrupting modern modulations signals which support high mobility forces. This project also demonstrates the technology products that enable, enhance and protect the commander's decision and execution cycle while influencing an opponent's. The fusing of multiple intelligence data inputs with one output will allow the commander to quickly assess the battlefield situation.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>2259 -Completed demonstration and testing of exploitation strategies for type 1 mobile cellular radio signals. Provided technology options for IEWCs.</li> <li>-Completed demonstration and testing of signal processing, control equipment and software techniques to demonstrate capability to identify and jam digital radio signals.</li> <li>-Initiated integration of exploitation strategies for type 2 mobile cellular radio signals for demonstration purposes.</li> <li>-Completed demonstrations of signals intelligence (SIGINT) asset management and automated map based intelligence sensor system (AMBISS). Transitioned to intelligence electronic warfare common sensor (IEWCS) and all source analysis system (ASAS).</li> <li>550 -Initiated IEW demonstration of asset management, terrain management, and overlay reasoning technologies developed in PE 0602270A/A906.</li> <li>-Integrated SIGINT/moving target indicator (MTI) templating, tracking, cross-cueing and situation display techniques.</li> <li>-Demonstrated the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus is on the ASAS/WARLORD and IEWCs interface. Demonstrated capability at train up for Task Force XXI advanced warfighting experiment (AWE).</li> </ul> <p>Total 2809</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1532 -Demonstrate utilization of techniques to exploit several complex communications formats.</li> <li>-Integrate wide band receiver and developments from joint receiver programs for demonstration of receivers used in the exploitation of modern communications signals.</li> <li>-Complete IEW asset management, terrain management and overlay reasoning demonstration and provide technology options for ASAS. Demonstrate at Task Force XXI AWE.</li> <li>1250 -Conduct field evaluation of SIGINT/MTI templating, tracking, cross-cueing and situation display techniques.</li> </ul>											

Project DK15

Page 2 of 5 Pages

Exhibit R-2 (PE 0603270A)

395

Item 36

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603270A Electronic Warfare (EW) Technology</b>	<b>DK15</b>	
<b>FY 1997 Planned Program: (continued)</b>			
	-Field test battle damage assessment prototype with 18th Airborne Corps -Continue consolidation and testing of IEW airborne asset management tools prior to demonstration. -Continue demonstration of the tools and techniques to effectively task and receive reports from modern multi-intelligence sensor platforms. Focus is on the ASAS/WARLORD and IEWCS interface to support Task Force XXI AWE. -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
• 70			
Total	2852		
<b>FY 1998 Planned Program:</b>			
• 1400	-Perform field evaluation/demonstration of attack techniques against modern communication signals.		
• 888	-Perform laboratory and field evaluation of high frequency (HF) and very high frequency (VHF) jamming antenna technology.		
• 595	-Demonstrate operational effectiveness of a wide bandwidth SIGINT electronic support package on a short-range UAV platform operating in conjunction with a ground base IEWCS.		
	-Complete prototype using smart agents to support effective tasking and reporting of multi-intelligence sensor data integrated into ASAS Block II and IEWCS.		
	-Develop initial prototype of terrain reasoning and SIGINT templating capability.		
	-Continue to upgrade airborne asset management prototype.		
	-Transition full military intelligence (MI) sensor asset management tools and techniques into ASAS and IEWCS.		
Total	2883		
<b>FY 1999 Planned Program:</b>			
• 2380	-Initiate demonstration against modern communication signals using the field programmable gate array analysis/control system.		
	-Perform laboratory and field evaluation of capabilities against more complex modern communication signals.		
• 741	-Continue antenna technology prototyping to support modern communication exploitation evaluations.		
	-Complete airborne asset management prototype. Product transitions to IEWCS and ASAS.		
	-Complete advanced terrain reasoning prototype. IEWCS and ASAS will be upgraded with this capability.		
	-Complete SIGINT templating prototype. IEWCS and ASAS will be upgraded with this capability.		
Total	3121		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	2881	2913	2878
Adjustments to Appropriated Value	2963	2852	3117
FY 1998 Pres Bud Request	-154		
	2809	2852	2883
			3121
Project DK15		Exhibit R-2 (PE 0603270A)	

Page 3 of 5 Pages

Exhibit R-2 (PE 0603270A)

396

Item 36

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603270A Electronic Warfare (EW) Technology

DK16

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK16 Non-Communications Electronic Countermeasures Technology Demonstration	1009	3799	5299	8633	9538	10396	7501	8232	Continuing	Continuing

**A. Mission Description and Justification:** This program demonstrates the feasibility and effectiveness of non-communication electronic warfare hardware and software CM technology for self protection against radar, optical, electro-optical and infrared (IR) threats. The multispectral countermeasures advanced technology demonstration (MSCM ATD) provides technology options for product improvements to the suite of integrated infrared countermeasures/common missile warning system (SIIRCM/CMWS), which provides the primary protection to Army helicopters against infrared seeker missiles. Specifically, advancements in laser technology will provide a multi line laser for improved self protection, advancements in fiber optic technology for improved transmission to the SIIRCM jamhead, and the evaluation of infrared (IR) countermeasure (CM) techniques versus IR imaging missiles.

**FY 1996 Accomplishments:**

- 1009 -Developed algorithms for passive missile warning, integrated ground vehicle top attack missile warning components, and delivered top attack warning subsystem to hit avoidance advanced technology demonstration (ATD).

Total

1009

**FY 1997 Planned Program:**

- 3712 -Evaluate candidate fiber optic cables and jamming waveforms to increase jam to signal ratios; evaluate Air Force Lincoln Labs diode pumped, long pulse laser technology as an alternative to defense advanced projects agency (DARPA) solid state multiline, short pulse lasers; initiate development of interfaces between laser modules and multispectral countermeasures test bed hardware.
- 87 -Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

3799

**FY 1998 Planned Program:**

- 3500 -Complete integration of laser modules with multispectral countermeasures test bed, and begin integration of band four fiber optic cable.
- 1799 -Collect missile signature data to support improved detection algorithm developments; initiate development of warning and countermeasures against far IR laser beam rider threats.

Total

5299

Project DK16

Page 4 of 5 Pages

Exhibit R-2 (PE 0603270A)

397

Item 36

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603270A Electronic Warfare (EW) Technology

DK16

## FY 1999 Planned Program:

- 7000 - Complete multispectral countermeasures test bed; conduct system integration lab tests and live fire cable car tests against advanced pseudo imaging and imaging surface to air missiles; demonstrate detection and countermeasures against guided missiles that can engage both rotary wing aircraft and ground vehicles.
- Transition alternative laser technologies, jamming waveforms, fiber optic cable and missile detection algorithms as technology options for SIIRCM product improvement.
- 1633 -Continue development of laser beam rider detection and jamming demonstrator using SIIRCM as core demonstration system.
- Total 8633

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
1031	3881	5303	8651
1059	3799		
-50			
1009	3799	5299	8633

Project DK16

Page 5 of 5 Pages

Exhibit R-2 (PE 0603270A)

398

Item 36

UNCLASSIFIED



## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

## BUDGET ACTIVITY

## PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603313A Missile and Rocket Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	109972	99819	117139	89542	49582	23675	16147	21243	Continuing	Continuing
D206 Missile Simulation	2497	1	3013	3434	3675	3660	3684	3990	Continuing	Continuing
D263 Future Missile Technology Integration (FMTI)	19174	9541	1043	19	1001	963	12463	17253	Continuing	Continuing
D375 Low Cost Autonomous Attack Submunition (LOCAAS)	2372	0	0	0	0	0	0	0	0	2372
D380 Multi-Platform Launcher	3582	13232	12431	8780	5489	0	0	0	0	43514
D387 Multi-Purpose Individual Munition	4907	625	0	0	0	0	0	0	0	5532
D486 Rapid Force Projection Simulation	5627	7656	8390	5111	0	0	0	0	0	26784
D493 Rapid Force Projection Demonstration	16537	23737	29682	27772	13513	11317	0	0	0	112558
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	55276	36214	57734	36605	14948	3791	0	0	0	204568
D549 2.75 Inch Anti-Air TD	0	0	2905	2896	0	0	0	0	0	5801
D550 Counter Active Protection System	0	1	1941	4408	5467	0	0	0	0	11817
D567 LCPK for 2.75 Inch Rockets	0	0	0	517	5489	3944	0	0	0	9950
D703 Hydra-70 Rocket PIP	0	8812	0	0	0	0	0	0	0	8812

**Mission Description and Budget Item Justification:** This program element provides advanced missile technologies to enhance U. S. Army force structure. Major objectives for investigation are system deployability, lethality, survivability, flexibility and affordability. Work is conducted through system simulation/virtual prototyping,

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

## 0603313A Missile and Rocket Advanced Technology

system design, hardware development and test, and demonstration in laboratory and operational scenarios. This program element provides for the demonstration of advanced tactical missiles and systems using missiles and includes real-time hardware-in-the-loop simulation technology, multi-role fire-and-forget seeker technologies capable of locating targets in clutter, lightweight launcher improvements and enhanced rocket accuracy, advanced technologies for missile guidance, missile warheads, and hypervelocity missile technologies. This program element also provides full integration of battlefield technologies including hunters (forward sensors) and killers (weapons) integrated through advanced command and control. These components will demonstrate a system of systems approach through the umbrella of the Rapid Force Projection Initiative (RFPI) Early Entry Demonstration, which will provide enhanced survivability and lethality for light, early-entry U.S. forces in a contingency role. The RFPI demonstration supports four of the twelve future joint warfighting capabilities, to promptly engage regional forces in decisive combat on a global basis, and is supported by the Dismounted Battlespace Battle Lab (DBBL), with participation from the 18th Airborne Corps. This program element now contains the only Army demonstration of fiber optic guided missile technology and will support the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD), a DoD priority program. Multiple EFOG-M fire units and missiles (with a limited manrating) will participate in RFPI field tests. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, Project Reliance, and supports multiple Defense Technology Objectives. This program element supports the U.S. Army Training and Doctrine Command (TRADOC) Battle Labs. Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University and Industry Research Centers), PE 0602303A (Missile Technology), PE 0603238A (Air Defense/Precision Strike Technology), and PE 0603363F in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. These projects include proof of principle field demonstrations and tests of technologies to meet specific military needs and are therefore properly placed in Budget Activity 3.

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

0603313A Missile and Rocket Advanced Technology

PROJECT

D206

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D206 Missile Simulation	2497	1	3013	3434	3675	3660	3684	3990	Continuing	Continuing

**A. Mission Description and Justification:** This project supports three separate, but related tasks: (a) development, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities applicable to the evaluation of tactical missiles guided by signals in radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) electromagnetic spectral regions. Evaluation by means of HWIL provides cost effective support to missile development throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. HWIL simulation employs actual missile guidance and control hardware operating in real-time in a non-destructive laboratory environment; (b) Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Projects Agency (DARPA) Defense Simulation Internet; and (c) Battlefield Environment Weapon System Simulation (BEWSS), which provides an all-analytical simulation of a weapon system engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscuration and disturbances. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command (MICOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and Nichols Research Corporation, Huntsville, AL.

## FY 1996 Accomplishments:

- 1853 - Upgraded and improved RF HWIL simulation capabilities with new hardware (instrumentation and computers) to support LONGBOW, pre-planned product improvement (P3I) BAT, and PATRIOT Advanced Capability Block 3 (PAC-3) development.
- Developed new HWIL simulation capabilities to support customers in other services and friendly foreign governments with electronic countermeasure evaluations.
- Implemented infrared target scene projector for application to JAVELIN, BAT, Future Missile Technology Integration (FMTI) (formerly The Army Combined Arms Weapon System ), and Theater High Altitude Air Defense (THAAD) development via hardware-in-the-loop simulation.
- Reconfigured the Electro-Optical Simulation System for HWIL simulation of EFOG-M and FMTI (TACAWS) by addition of a rotational flight motion simulator, computers and infrared instrumentation..
- 644 - Expanded basic distributed interactive simulation capability at the MICOM Defense Simulation Internet node and local network supporting BRADLEY STINGER Fighting Vehicle (BSFV), Line-of-Sight Anti-Tank (LOSAT), JAVELIN, Army Tactical Missile System/BAT (ATACMS/BAT) and Multiple Launch Rocket System (MLRS).
- Developed improvements to the BEWSS suite of simulation models.

Total 2497

## FY 1997 Planned Program:

- 1 - Plan FY98 program.
- Total 1

Project D206

Page 3 of 28 Pages

Exhibit R-2 (PE 0603313A)

401

Item 37

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
3 - Advanced Technology Development	0603313A Missile and Rocket Advanced Technology	February 1997	D206
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1950 - Complete the development of computer-controlled precision signal measurement instrumentation for microwave and millimeter wave radar hardware-in-the-loop simulation capabilities.</li> <li>- Initiate development of technology which supports hardware-in-the-loop simulation of dual-spectrum (infrared and millimeter wave radar) guided and sensor-fuzed tactical missiles and submunitions (BAT P3I and SADARM PI).</li> <li>- Extend infrared target and background scene projector technology by increasing pixel dimensions and frame rates and by improving non-uniformity correction algorithms.</li> </ul> <p>Investigate infrared scene projector "leap ahead" technology in an effort to overcome limitations of present scene projector technologies.</p> <ul style="list-style-type: none"> <li>- Continue development of hardware/software based on commercial off-the-shelf products for real-time target scene generation for driving electro-optical scene projectors.</li> </ul> <ul style="list-style-type: none"> <li>1063 - Complete the reconfiguration of the Electro-Optical Simulation System to provide hardware-in-the-loop simulation support to EFOG-M, FMTI, and THAAD missile systems.</li> <li>- Upgrade MICOM DIS Center real-time data processing and display support essential virtual prototype simulator development and exercise operations.</li> <li>- Upgrade BEWSS test bed capabilities to support DIS exercises integrating live, virtual, and constructive forces into a seamless environment.</li> </ul> <p>Total 3013</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>2584 - Continue the development of a hardware-in-the-loop (HWIL) simulation capability for dual-spectrum (passive infrared and millimeter wave radar) guided and sensor-fuzed tactical missiles and sub-munitions to support development of BAT P3I, SADARM PI, their successors, and other dual mode guided weapons.</li> <li>- Upgrade infrared scene projection capability by improving the laser diode projector performance and fabricating electronics for a resistive element chip of at least 512x512 pixel dimensions. Upgrade scene generator performance with additional processors and improved software to provide acquisition support to EFOG-M, Follow-on To TOW (FOTT), THAAD, and other infrared guided weapons.</li> <li>- Continue development of "leap ahead" infrared scene projector technology to overcome disadvantages of all present projector systems. This technology will support development and test and evaluation for all infrared guided missiles and submunitions.</li> <li>- Develop integrated microcircuits for intermediate/radio frequency (RF) phase coherency, delay, and quadrature modulator functions with improved bandwidth and noise characteristics to insert benefits of digital electronics into radar signal generation for HWIL simulation. This effort will support LONGBOW, PAC-3, and other millimeter wave radar guided missiles.</li> <li>- Improve performance of computer-controlled special-purpose precision signal measurement instrumentation for microwave and millimeter wave radar HWIL simulation capabilities.</li> </ul>			

Project D206

Page 4 of 28 Pages

Exhibit R-2 (PE 0603313A)

402

Item 37

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603313A Missile and Rocket Advanced Technology</b>	<b>D206</b>																										
<p><b>FY 1999 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>850 - Provide upgraded virtual prototype and real-time computer generated forces capability for the Distributed Interactive Simulation Center, including improved accuracy and lower cost to meet R&amp;D needs.</li> <li>- Implement upgraded BEWSS test bed capability to provide improved control, integration, operation, data collection and analysis.</li> <li>- Upgrade BEWSS environmental models to support engineering evaluation of enhanced weapon system seekers/sensors.</li> </ul> <p>Total 3434</p>																												
<p><b>B. Project Change Summary</b></p> <table border="0"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>3064</td> <td>2973</td> <td>3007</td> <td>3928</td> </tr> <tr> <td>Appropriated Value</td> <td>3150</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>-653</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 President's Budget Request</td> <td>2497</td> <td>1</td> <td>3013</td> <td>3434</td> </tr> </tbody> </table>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	3064	2973	3007	3928	Appropriated Value	3150	1			Adjustments to Appropriated Value	-653				FY 1998 President's Budget Request	2497	1	3013	3434
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Appropriated Value	3150	1																										
Adjustments to Appropriated Value	-653																											
FY 1998 President's Budget Request	2497	1	3013	3434																								
<p>Change Summary Explanation: Funding: FY 1996- Funding reprogrammed to higher priority requirements.  FY 1997- Funding (-2972) redirected to Congressionally-mandated Hydra-70 product improvement program.  FY 1998- Funding reprogrammed (-494) to higher priority requirements.</p>																												

Project D206

Page 5 of 28 Pages

Exhibit R-2 (PE 0603313A)

403

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

06033313A Missile and Rocket Advanced

D263

## Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D263 Future Missile Technology Integration (FMTI)	19174	9541	1043	19	1001	963	12463	17253	Continuing	Continuing

**A. Mission Description Justification:** This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, warheads, and guidance and control. The project will demonstrate lightweight multi-role missile technology in support of ground-to-ground, ground-to-air, air-to-air and air-to-ground missions. Combined, flexible capability allows one system or variants of one system to replace many, realizing potential extensive savings in development costs, logistics, training, etc. Particular attention will be given to the development of infrared (IR) seeker technology capable of long range lock-on and defeat of helicopters buried in cluttered backgrounds, variable thrust propulsion allowing system range extension and thus standoff and high survivability, and the innovative use of RF data links for identification friend or foe, and the attack of targets masked from the launch platform. The missile system demonstration includes the integration of guidance, control, propulsion, airframe and warhead technologies capable of performing in high clutter/obscure, adverse weather environments and under countermeasure conditions. Missile control and guidance system technology will explore capabilities such as lock-on before/lock-on after launch, fire and forget, command guidance, imaging infrared signal and image processing, and wide band secure data links. Multi-mission seeker (M<sup>2</sup>S) technology transitioned from the Balanced Technology Initiative program will continue to be evaluated. Demonstrated missile system performance (i.e.; weight, range, kill ratio, speed, lethality) will be optimized to exceed current baseline parameters of ground-to-ground tube launched optically-tracked wire-guided (TOW), ground-to-air Stinger, air-to-air Stinger, and Air-to-Ground Missile System (AGMS) in a size compatible with the TOW launcher. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command (MICOM), Redstone Arsenal, AL. Major contractors are Raytheon Company, Electronic Systems, Tewksbury, MA; TRW Space Electronics Group, Redondo Beach, CA; Loral Communications Systems, Salt Lake City, UT.

## FY 1996 Accomplishments:

- 12893 - Completed procurement of flight hardware.
- 6281 - Completed seeker captive flight tests.
- 6281 - Initiated construction of HWIL simulation of flight hardware.
- Completed six degrees of freedom (6DOF) simulation system evaluation and supported missile flight tests.

Total 19174

Project D263

Page 6 of 28 Pages

Exhibit R-2 (PE 06033313A)

404

Item 37

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603313A Missile and Rocket Advanced Technology</b>	<b>D263</b>																										
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 9342 - Design and fabricate gunner fire control console.</li> <li>- Initiate technology demonstration flight tests.</li> <li>- Transition technology to ongoing missile programs (e.g. Follow-On-To-TOW and EFOG-M).</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 9541</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1043 - Complete technology demonstration flight tests.</li> <li>- Transition final documentation to technology transition database.</li> <li>- Complete final report.</li> </ul> <p>Total 1043</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 19 - Develop program plan for proposed ATD.</li> </ul> <p>Total 19</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>18615</td> <td>9020</td> <td>1029</td> <td>1297</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>19137</td> <td>9541</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>37</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>19174</td> <td>9541</td> <td>1043</td> <td>19</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1999- Funds (-1278) reprogrammed to higher priority requirements.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	18615	9020	1029	1297	Adjustments to Appropriated Value	19137	9541			FY 1998 Pres Bud Request	37					19174	9541	1043	19
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UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced Technology

D375

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D375 Low Cost Autonomous Attack Submunition (LOCAAS)	2372	0	0	0	0	0	0	0	0	2372

**A. Mission Description and Justification:** Additional funds were provided by Congress in this program element for the LOCAAS project. This project provided for the demonstration of the tactical Laser Radar (LADAR) seeker intended for use in powered submunitions. The project demonstrated the technology in weather and countermeasures. A weather and countermeasures performance data base for the LADAR seeker was built for use in the MLRS Smart Tactical Rocket (MSTAR) cost, operations, and effectiveness analysis (1996-1997) and other battlefield simulations. Work was performed by the Research, development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor was Loral Vaught Systems of Dallas, Texas.

**FY 1996 Accomplishments:**

- 2372 - Began configuration of LADAR seeker for captive flight testing.
- Completed captive flight test planning.

Total 2372

FY 1997 Planned Program: Project not funded in FY 97.

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996	FY 1997	FY 1998	FY 1999
2433	0		0
2500			
128			
2372	0	0	0

Project D375

Page 8 of 28 Pages

Exhibit R-2 (PE 0603313A)

406

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

D380

## Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D380 Multi-Platform Launcher	3582	13232	12431	8780	5489	0	0	0	0	43514

**A. Mission Description and Justification:** This project is part of the Rapid Force Projection Initiative (RFPI) ACTD for early entry forces and is also tied to the Joint Precision Strike Demonstration (JPSD) Precision/Rapid Counter Multiple Rocket Launcher (MRL) ACTD. The Multi-Platform Launcher (MPL) program will explore and implement technologies to improve the deployability and lethality of the MLRS system for counter battery, counter armor, and critical target missions. The first phase of the MPL program (to FY 1998) will design, develop, and flight test a low cost guidance and control system for the MLRS free-flight rocket, thereby substantially improving its delivery accuracy, reducing the number of rockets required to defeat the target, and expanding the set of MLRS targets to include precision targets. The guidance system will make use of inertial and Global Positioning System (GPS) low cost component technologies. A more accurate rocket results in both a more lethal force and a reduced logistics burden, which is especially important for early entry. The second phase of the program will support the design and testing of the High Mobility Artillery Rocket System (HIMARS), a C-130 transportable MLRS launcher. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor is Loral Vought Systems, Dallas, TX.

## FY 1996 Accomplishments:

- 1746 - Constructed flight computers, algorithms and software.
- Constructed control actuation systems.
- Completed design of global positioning system (GPS) algorithms.
- Established GPS antenna and receiver specifications.
- 1836 - Developed electronic and power systems.
- Developed launcher interfaces.
- Performed structural/thermal and aerodynamic analysis.
- Developed inertial measurement units.

Total 3582

## FY 1997 Planned Program:

- 5105 - Perform software integration and testing.
- Perform system integration and hardware-in-the-loop testing.
- Perform navigation/autopilot/guidance analysis.
- Develop telemetry system.
- Develop and test roll-control bearing.

Project D380

Page 9 of 28 Pages

Exhibit R-2 (PE 0603313A)

407

Item 37

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	PROJECT
BUDGET ACTIVITY	PE NUMBER AND TITLE		
<b>3 - Advanced Technology Development</b>	<b>0603313A Missile and Rocket Advanced Technology</b>		<b>D380</b>
<b>FY 1997 Planned Program: (continued)</b>			
	- Develop and test missile electronic unit.		
•	- Develop and test GPS components (receiver and antenna).	1756	
	- Develop GPS guidance algorithms, receiver, and antenna.		
•	- Conduct risk reduction pre-EMD design on safe and arm, electronics miniaturization, warhead packaging, and launcher operations.	2926	
•	- Initiate safety qualification and man rating evaluations of HIMARS.	3122	
	- Integrate HIMARS into RFPI evaluations.		
•	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.	323	
Total		13232	
<b>FY 1998 Planned Program:</b>			
•	- Perform 3 Guided MLRS flight tests with Inertial Measurement Unit (IMU) guidance.	4532	
	- Integrate and flight test 2 Guided MLRS GPS-aided IMU.		
	- Transfer Guided MLRS technology to EMD.		
•	- Complete HIMARS design.	7899	
	- Fabricate HIMARS residual hardware.		
	- Test HIMARS hardware prior to firings, including electromagnetic testing, road tests, and man rating.		
	- Test firings of HIMARS at White Sands Missile Range, including range costs.		
Total		12431	
<b>FY 1999 Planned Program:</b>			
•	- Provide maintenance, spares, replacements, and repairs for HIMARS residuals, to be evaluated by the user as a part of the Rapid Force Projection Initiative.	4780	
	- Provide Improved Position Determining System (IPDS) retrofit kits for residual hardware.		
	- Provide government furnished equipment to contractor.		
	- Provide support for interim HIMARS maintenance facility.	4000	
Total		8780	
Project D380		Exhibit R-2 (PE 0603313A)	
		Page 10 of 28 Pages	Item 37

408

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 EXHIBIT)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced Technology

D380

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996

3675

3779

-197

3582

FY 1997

5515

13232

13232

FY 1998

8660

12431

FY 1999

6882

8780

Change Summary Explanation: Funding:

FY 1997- Funding increased by Congress (+7717) for risk reduction activities leading to Guided MLRS Engineering and Manufacturing Development.

FY 1998- Funding (+3771) increased to support risk reduction activities and transition to EMD.

FY 1999- Funding (+1898) increased to provide residual support for HIMARS.

Project D380

Page 11 of 28 Pages

Exhibit R-2 (PE 0603313A)

409

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

D387

## Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D387 Multi-Purpose Individual Munition	4907	625	0	0	0	0	0	0	0	5532

**A. Mission Description and Justification:** This project provides for demonstration of a lightweight, shoulder fired, multiple purpose weapon. It provides the Army with one weapon capable of defeating enemy forces in buildings, bunkers, and lightly armored vehicles. The Multiple Purpose Individual Munition/Short Range Anti-tank Weapon (MPIM/SRAW) is capable of being fired from its carrying configuration and can be safely fired from an enclosure for the close battle. The MPIM/SRAW demonstration integrates warhead technology developed by the Army with the United States Marine Corps (USMC) propulsion system developed for SRAW. It will replace the AT4 system, which was only designed to defeat light armor. The system developed will have significantly improved lethality over the AT4, as well as being multiple target capable, which is particularly important in contingency operations. In FY 97 producibility efforts will be initiated to reduce the cost of guidance hardware to reduce unit costs of the system. The technology will transition to the MPIM development program in PE 0604802A, Weapons and Munitions Engineering Development, at the end of FY 97. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. The major contractor is Loral Aeronautics, Rancho Santa Margarita, CA.

## FY 1996 Accomplishments:

- 3168 - Completed system hardware fabrication and testing.
- 1739 - Completed technology demonstration.
- Completed accuracy and lethality evaluation.
- Conducted milestone review for entry into engineering and manufacturing development (EMD).

Total 4907

## FY 1997 Planned Program:

- 610 - Issue Request For Proposal (RFP) for low-cost guidance.
- Conduct a study to identify high cost items to address producibility.
- Transition to engineering and manufacturing development.
- 15 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 625

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

Project D387

Page 12 of 28 Pages

Exhibit R-2 (PE 0603313A)

410

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

D387

Technology

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget

FY 1996

4450

4575

332

4907

FY 1997

813

625

FY 1998

0

FY 1999

0

Change Summary Explanation: Funding: FY 1997 (-188) funds redirected to Congressionally mandated Hydra-70 product improvement program.

Project D387

Page 13 of 28 Pages

Exhibit R-2 (PE 0603313A)

411

Item 37

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603313A Missile and Rocket Advanced Technology

D486

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D486 Rapid Force Projection Simulation	5627	7656	8390	5111	0	0	0	0	0	26784

**A. Mission Description and Justification:** The RFPI Simulation Support Plan and the RFPI Study Plan provide a detailed description of the simulation and analysis efforts underway to support the RFPI program. Scenario development, force-on-force modeling, and simulation are currently supported by detailed engineering models, preliminary system performance estimates/data, and other system models and simulations provided by the RFPI program and the individual Advanced Technology Demonstrations/Technology Demonstrations (ATDs/TDs). All simulations and analyses will be performed under the guidance and supervision of the Integrated Battlefield Simulation and Analysis Team (IBSAT). Simulations and analyses will support the determination of value-added proposed technologies for the RFPI ACTD and will be utilized to determine the mix and number of developmental sensors to be used in the Advanced Warfighting Experiment (AWE) and subsequently to determine residual quantities and support requirements. Work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. Major contractors are Computer Science Corporation, Huntsville, AL, and Nichols Research Corporation, Huntsville, AL.

**FY 1996 Accomplishments:**

- 3340 - Performed record runs, document and staff run matrices for BEWSS, JANUS, and CASTFOREM.
- 2287 - Completed EFOG-M Virtual Prototype Demonstration (VPD) AWE and Anti-Armor ATD experiment number six.
- - Completed integration follow-on scenarios into BEWSS, JANUS, and CASTFOREM.
- - Provided real/virtual integration support.

Total

5627

**FY 1997 Planned Program:**

- 7468 - Document results of BEWSS, CASTFOREM, and JANUS runs.
- - Perform BEWSS record runs Command and Control (C2) simulations.
- - Execute ACTD and prepare for BLWE virtual exercise.
- - Perform final predictions for ACTD Model-Test-Model.
- 188 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total

7656

**FY 1998 Planned Program:**

- 1320 - Modify draft Ft. Benning scenarios for virtual rehearsal experiment to accommodate field elements.
- - Refine Ft. Benning terrain database.

Project D486

Page 14 of 28 Pages

Exhibit R-2 (PE 0603313A)

412

Item 37

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
3 - Advanced Technology Development	0603313A Missile and Rocket Advanced Technology		D486	

FY 1998 Planned Program: (continued)				
•	1920	- Perform post-rehearsal model-experiment-model runs and analysis.		
•	1800	- Perform final modifications to manned simulations.		
•	3000	- Use manned simulators and semi-automated forces to provide rehearsal of ACTD experiment.		
•	350	- Perform final real/virtual hardware integration.		
•		- Integrate, prepare and execute ACTD experiment.		
•		- Perform CASTFOREM tradeoff runs.		
Total	8390			

FY 1999 Planned Program:				
•	1000	- Provide virtual simulation resources to support real/virtual experiments during the residual period.		
•	1600	- Apply RFPI technologies to excursion scenarios to include urban, varying terrain, weather, and countermeasures.		
•		- Perform post ACTD model-experiment-model runs and analysis.		
•		- Perform excursion runs and analysis.		
•	1800	- Provide support for manned simulator residual.		
•	711	- Perform final cost and operational effectiveness analysis (COEA).		
Total	5111			

B. Project Change Summary				
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	5772	7849	8405	5115
Adjustments to Appropriated Value	5945	7656		
FY 1998 President's Budget Request	-318			
	5627	7656	8390	5111

Project D486

Page 15 of 28 Pages

Exhibit R-2 (PE 0603313A)

Project D486

Page 15 of 28 Pages

Exhibit R-2 (PE 0603313A)

413

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

D493

## Technology

	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D493 Rapid Force Projection Demonstration		16537	23737	29682	27772	13513	11317	0	0	0	112558

**A. Mission Description and Justification:** The integrated system of systems concept of this ACTD provides lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. This ACTD will evaluate the value added by the insertion of these new technologies into the force structure of an existing light unit in a lift constrained environment. The inserted systems will consist of forward sensors (hunters), advanced C2, and a suite of standoff killers. The mix of forward sensors used to complement and enhance existing unit assets includes both manned and unmanned air and ground systems. The sensor architecture will be based on the unit equipment, as documented in the U.S. Army Intelligence Master Plan and the U.S. Army Modernization Plan, and will be augmented with other sensors and processors, as required, to ensure forward sensors are properly cued. Tactical sensors (organic and advanced) will receive cueing information from these sensors to rapidly focus them on targets. The mix of standoff killers complements and extends the capabilities of current systems. The EFOG-M, a Brigade asset, is a lightweight, man-in-loop non-line of sight guided missile which is lethal to a variety of high priority targets, including heavy armor. Howitzers are organic to the Division and Corps artillery and operate in direct and general support of the Maneuver Brigade. The exact mix of 105/155 mm howitzers will be determined by the AWE manager in conjunction with the FORSCOM Unit, and the Depth and Simultaneous Attack Battle Lab (D&SA BL). The lightweight and Highly Mobile Artillery Rocket and Missile System (HIMARS) rocket firing platform, which uses a wheeled chassis, will be a Corps asset which is attached to the Maneuver Brigade. The deployability of the Division Ready Brigade Minus (DRB(-)) will not be affected throughout the evaluation of the systems. This ACTD will include both simulation and field demonstration phases, and will encourage user exploration of excursions from the baseline Tactics, Techniques, and Procedures (TTPs) to optimize utility of the standoff killers, forward sensors, and advanced C2 for the light forces. Integrated demonstration work is performed by the Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, AL. Major contractors are Nichols Research Corporation, Huntsville, AL; and Computer Sciences Corporation, Huntsville, AL.

## FY 1996 Accomplishments:

- 8420 - Provided support equipment for demonstration.
- Finalized HIMARS design.
- 4087 - Ordered long-lead items for HIMARS, including vehicles, launcher components, and raw materials.
- Initiated fabrication of HIMARS prototypes/surrogates.
- Completed verification and validation plan for DIS simulators.
- 4030 - Provided integrated technology program technical support.
- Completed program plans and documentation.
- Finalized communications equipment definition.

Total 16537

Project D493

Page 16 of 28 Pages

Exhibit R-2 (PE 0603313A)

414

Item 37

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603313A Missile and Rocket Advanced Technology</b>	<b>D493</b>	
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 6700 - Continue HIMARS design.</li> <li>- Initiate developmental testing of HIMARS.</li> <li>- Continue fabrication of HIMARS prototypes/surrogates.</li> <li>• 5480 - Integrate ATD/TD systems into RFPI System-of-Systems.</li> <li>- Conduct and complete captive flight tests of sensors.</li> <li>• 10977 - Perform training and integration elements at test installation.</li> <li>- Conduct technical/operational risk reduction experiments.</li> <li>- Procure sensor, communications equipment, and special test equipment.</li> <li>- Conduct producibility and configuration management.</li> <li>- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> <li>580</li> </ul> <p>Total 23737</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 9124 - Provide RFPI and Opposition Forces (OPFOR) instrumentation and support, including targets.</li> <li>- Provide communications support for experiment, including equipment spares/TAC radios.</li> <li>- Provide additional sensors and sensor support equipment.</li> <li>• 12000 - Develop hardware and software for special test instrumentation.</li> <li>- Conduct user training and perform installation and checkout of System-of-Systems experiment instrumentation.</li> <li>- Conduct Large Scale Field Experiment.</li> <li>- Prepare for residual support.</li> <li>• 8558 - Provide logistics support for ACTD.</li> <li>- Provide support for training and troops.</li> <li>- Provide support for residual hardware.</li> <li>- Provide support for program evaluation and integration.</li> </ul> <p>Total 29682</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 7050 - Provide maintenance, replacement parts, and spares in direct support of user units.</li> <li>- Provide spare batteries, cables, and other replacement parts for communications equipment.</li> <li>- Provide RFPI integrated logistics support, personnel, analysis, and training.</li> </ul>			

Project D493

Page 17 of 28 Pages

Exhibit R-2 (PE 0603313A)

415

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

PROJECT

D493

Technology

## FY 1999 Planned Program: (continued)

- 14696 - Provide training on residual equipment for experiment units.
- Provide residual support for EFOG-M.
- Provide residual support for hunter/killer systems and integrated acoustic system.
- 6026 - Provide analysis and red team support including countermeasure/counter-countermeasure analysis and preparation for possible milestone review.
- Total 27772

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996	FY 1997	FY 1998	FY 1999
17477	24245	29774	27876
17967	23737		
-1430			
16537	23737	29682	27772

Project D493

Page 18 of 28 Pages

Exhibit R-2 (PE 0603313A)

416

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced Technology

D496

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D496 Enhanced Fiber Optic Guided Missile (EFOG-M)	55276	36214	57734	36605	14948	3791	0	0	0	204568

**A. Mission Description and Budget Item Justification: Project D496 - Enhanced Fiber Optic Guided Missile (EFOG-M):** The Enhanced Fiber Optic Guided Missile (EFOG-M) is the primary "killer" within the "hunter/standoff killer" concept of the Rapid Force Projection Initiative (RFPI) ACTD. The EFOG-M system is a multi-purpose, precision kill weapon system. The primary mission of the EFOG-M is to engage and defeat threat armored combat vehicles, other high value ground targets, and hovering or moving rotary wing aircraft that may be masked from line of sight direct fire weapon systems. EFOG-M is a day/night, adverse weather capable system that allows the maneuver commander to extend the battle space beyond line of sight to ranges up to 15 kilometers. The system consists of a gunner's station, a tactical missile, and a fiber optic data link plus command vehicles. The missile can navigate to the target area, and the gunner can intervene at any time to lock on and engage any detected targets. The gunner views the flightpath and target via a seeker on the missile linked to the gunner's video console. The missile to be demonstrated will incorporate an IR imaging seeker, a variety of advanced targeting functionalities and a global positioning system (GPS)-based inertial measurement unit for accurate targeting. The RFPI ACTD will demonstrate a semi-automated target transfer from forward sensors (hunters) to an EFOG-M weapon system (killer) using C3 integration, and will fully explore the capability to expand the brigade level battle space through the use of simulation, TRADOC Battle Lab warfighting experiments and demonstrations. The ACTD will demonstrate the ability to conduct essential targeting and intelligence collection using forward sensors and real-time communications to provide for precision engagements against a variety of high priority targets, including armored vehicles. An integral element of the ACTD concept is allowing the participating unit to retain developmental items from the ACTD to provide residual operational capability.

**FY 1996 Accomplishments:**

- 2085 - Participated in a Virtual Prototype Experiment.
- 38930 - Continued design, fabrication, and testing of EFOG-M missiles, fire units, and platoon leader vehicles for the RFPI ACTD.
- 5094 - Initiated manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles to support the Extended User Evaluation (EUE).
- 9167 - Continued integration and management of design and fabrication effort.
- Total 55276

**FY 1997 Planned Program:**

- 7406 - Continue design, fabrication, and testing of EFOG-M missiles, fire units, and platoon leader vehicles for the RFPI ACTD.
- 9195 - Continue manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles to support the Extended User Evaluation (EUE).
- 18749 - Continue integration and management of design and fabrication effort.
- 864 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 36214

Project D496

Page 19 of 28 Pages

Exhibit R-2 (PE 0603313A)

417

Item 37

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603313A Missile and Rocket Advanced Technology	D496	
FY 1998 Planned Program:			
•	41427 - Continue manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles to support the Extended User Evaluation (EUE).		
•	16307 - Continue integration and management of design and fabrication effort.		
Total			
FY 1999 Planned Program:			
•	24327 - Continue manufacturing of EFOG-M missiles, fire units, and platoon leader vehicles to support the Extended User Evaluation (EUE) and testing.		
•	12278 - Continue integration and management of design and fabrication effort.		
Total			
B. Project Change Summary			
FY 1997 President's Budget		FY 1997	FY 1999
Appropriated Value		37680	57920
Adjustments to Appropriated Value		36214	36745
FY 1998 President's Budget Request		36214	57734
			36605

Project D496

Page 20 of 28 Pages

Exhibit R-2 (PE 0603313A)

Project D496

Page 20 of 28 Pages

Exhibit R-2 (PE 0603313A)

418

Item 37

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE									PROJECT
3 - Advanced Technology Development		0603313A Missile and Rocket Advanced Technology									D549
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D549	2.75 Inch Anti-Air TD	0	0	2905	2896	0	0	0	0	0	5801
<p><b>A. Mission Description and Justification:</b> The objective of this project is to demonstrate the technology for a comprehensive upgrade to the STINGER missile system through the incorporation of an advanced imaging infrared seeker to enable the engagement of hostile helicopters in clutter at extended ranges (2-3x). This project will demonstrate the ability to package the previously developed commercial breadboard signal processing electronics in a 2.75 inch diameter seeker. In addition, signal processing algorithms for target detection, tracking, and IR counter-countermeasures will be developed and demonstrated via hardware in the loop simulations, ground tests, and captive carry tests. This seeker will maintain computability with existing STINGER launchers and retain STINGER's excellent capability against fixed wing aircraft.</p> <p><b>FY 1996 Accomplishments:</b> Program not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b> Program not funded in FY 97.</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1700 - Complete form-factored seeker electronics.</li> <li>1205 - Develop endgame and infrared counter-countermeasures(IRCCM) signal processing algorithms.</li> <li>- Develop Hardware-In-the-Loop (HWIL) simulation.</li> <li>- Perform acquisition and tracking tests.</li> <li>- Perform IRCCM tracking tests.</li> </ul> <p>Total 2905</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>1500 - Complete endgame and IRCCM signal processing algorithms.</li> <li>- Develop missile guidance algorithms.</li> <li>1396 - Develop platform/launcher interfaces.</li> <li>- Perform HWIL missile flight simulations.</li> <li>- Perform captive carry air-to-air tests.</li> </ul> <p>Total 2896</p>											

Project D549

Page 21 of 28 Pages

Exhibit R-2 (PE 0603313A)

419

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603313A Missile and Rocket Advanced  
Technology

D549

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996

0

FY 1997

0

FY 1998

2901

FY 1999

2890

0

0

2901

2890

Project D549

Page 22 of 28 Pages

Exhibit R-2 (PE 0603313A)

420

Item 37

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603313A Missile and Rocket Advanced Technology								D550	
		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D550	Counter Active Protection System	0	1	1941	4408	5467	0	0	0	0	11817
<p><b>A. Mission Description and Justification:</b> This project will develop and demonstrate technologies which can be applied to Anti Tank Guided Weapons (ATGW) for improving their effectiveness against threat armor equipped with active protection systems (APS). Current technology development is concentrated in the following areas: Radio Frequency (RF) Countermeasure (RFCM) technology for jamming or deceiving APS sensors used for detection, acquisition, and tracking; warhead integration and ballistic hardening of ATGW to reduce vulnerability to fragment impact.</p> <p><b>FY 1996 Accomplishments:</b> Project not funded in FY 96.</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1 - Plan FY98 program.</li> <li>Total 1</li> </ul> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 1941 - Perform dynamic demonstration of integrated long standoff warhead in missile structures and flight conditions.</li> <li>- Design and breadboard dual band threat RFCM concept and design wide band RFCM concept.</li> <li>- Upgrade test bed radar to emulate APS at dual bands.</li> <li>- Build and test components of deployable decoy countermeasure technology.</li> <li>Total 1941</li> </ul> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 2000 - Award BAA contract for developing Long Standoff Precursor Warhead technology.</li> <li>- Adapt U.S. Army Research Laboratory RF signature reduction and modification techniques for use on missiles with homing seekers.</li> <li>• 2408 - Construct breadboard wideband RFCM concept and test against APS threat radars and other postulated threats.</li> <li>- Perform flight demonstration of deployable decoy countermeasure system.</li> <li>Total 4408</li> </ul>											

Project D550

Page 23 of 28 Pages

Exhibit R-2 (PE 0603313A)

421

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced

D550

## Technology

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996

0

FY 1997

1942

1

FY 1998

1934

FY 1999

2409

4408

Change Summary Explanation: Funding: FY 1997- (-1941) funds redirected to congressionally mandated Hydra-70 product improvement program.

FY 1999 Funding increased (+1999) to allow for demonstration of advanced RFCM concept and conduct testing against APS threat radars.

Project D550

Page 24 of 28 Pages

Exhibit R-2 (PE 0603313A)

422

Item 37

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

0603313A Missile and Rocket Advanced Technology

PROJECT

D567

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D567 LCPK for 2.75 Inch Rockets	0	0	0	517	5489	3944	0	0	0	9950

**A. Mission Description and Justification:** This project provides for demonstration of a low cost, accurate (1-m CEP) guidance and control retrofit package for the 2.75-inch Hydra-70 rocket that provides a stand-off range ( $\geq 6$  km) capability against specified non-tank point targets. This capability will provide for a high single shot probability of hit ( $Ph \geq 0.7$ ) against the long range target, exceeding the current unguided 2.75-inch rocket baseline by 1 or 2 orders of magnitude and thereby providing a 4 to 1 increase in stowed kills at one third the cost per kill compared to current guided missiles. The resulting decrease in logistics burden is of significant benefit to a CONUS-based force projection Army and of particular importance in a rapid force projection scenario. In addition, the increased accuracy will minimize collateral damage, reduce risk of fratricide, and will reduce mission times and sorties resulting in increased system survivability. Two separate retrofit guidance package approaches, one based on a solid state (strapdown) mechanization of semi-active laser (SAL) guidance, and the other, based on a potentially much lower cost innovative laser beam follower mode of guidance denoted Scatterider, will be developed and tested in parallel, with user participation, to assure the most cost effective solution is obtained in the neckdown to one system for the transition to EMD. The tests will demonstrate technologies and techniques to overcome barriers such as: providing a low cost, producible strapdown mechanism for precision guidance; robust design for rolling airframe applications; component packaging in 2.75 - inch airframe; structural, vibration and shock considerations for guidance package retrofit to current 2.75 - inch Hydra-70 rockets; and stand-off range target acquisition and engagement techniques to address current free-rocket launch and flight dispersions. Work is performed by the Research, Development, and Engineering Center, U. S. Army Missile Command, Redstone Arsenal, AL. All of the effort for the Scatterider demonstration will be performed in-house, while the strapdown SAL will be accomplished in conjunction with a major contractor to supply the guidance section and support for the demonstrations.

**FY 1996 Accomplishments:** Project not funded in FY 96

**FY 1997 Planned Program:** Project not funded in FY 97

**FY 1998 Planned Program:** Project not funded in FY 98

**FY 1999 Planned Program:**

- 317 - Initiate in-house design of flight test hardware to evaluate the scatterider concept.
- 100 - Issue RFP for demonstration hardware and live fire test support to evaluate the strapdown SAL concept.
- 100 - Develop flight demonstration test plan.
- Total 517

Project D567

Page 25 of 28 Pages

Exhibit R-2 (PE 0603313A)

423

Item 37

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PROJECT

3 - Advanced Technology Development

PE NUMBER AND TITLE

0603313A Missile and Rocket Advanced  
Technology

D567

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 President's Budget Request

FY 1996

0

FY 1997

0

FY 1998

0

FY 1999

0

517

Change Summary Explanation: Funding: This program is a new start for FY 1999.

Project D567

Page 26 of 28 Pages

Exhibit R-2 (PE 0603313A)

424

Item 37

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603313A Missile and Rocket Advanced Technology

D703

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D703 Hydra-70 Rocket PIP	0	8812	0	0	0	0	0	0	0	8812

**A. Mission Description and Justification:** This is a Congressionally mandated program. The objective of this project is to demonstrate and qualify a new rocket motor for the Hydra-70 free flight rocket weapon system. The following conditions on this qualification program were mandated by Congress:

1. The rocket motor shall utilize composite propellant.
2. The rocket motor shall be a non-developmental item (NDI).
3. A Technical Data Package (TDP) detailing the design of the rocket motor shall be delivered.
4. The rocket motor shall be a form-fit-function replacement for MK-66 motor that is currently in production.
5. The rocket motor shall be certified for air worthiness on the AH-64 Apache Helicopter.

To fully comply with the Congressional Direction, the program will be executed in three self-contained and distinct Phases which are described as follows: Phase I consists primarily of source selection activities. Under this effort, a Request for Proposals (RFP) was issued which included a performance specification that was consistent with the program objectives and constraints. Utilizing this RFP, multiple contracts (4) were awarded to prospective rocket motor manufacturers. Under the Phase I effort each contractor was required to deliver 25 rocket motors each. The government conducts a limited qualification evaluation on each of the four motors designs, including environmental and static performance testing. The results of this limited test program are utilized to select a single vendor for the remainder of the qualification effort. Phase II is full ground qualification of the single down-selected rocket motor design. This effort includes a complete series of environmental, insensitive munitions, and static performance tests. Also included are a complete series of flight tests from a ground launcher that shall determine flight performance and launcher compatibility. Approximately 500 rocket motor firings will be conducted (150 static and 350 flights). Phase III is flight qualification on the AH-64 Apache. Approximately 2000 rocket motors will be launched off the Apache to demonstrate full compatibility with the launch platform. With the conclusion of Phase III, the rocket motor will be fully qualified for air worthiness on the AH-64.

**FY 1996 Accomplishments:** Congressionally mandated program, funded in PE 0203802A, Other Missile Product Improvement Programs.

**FY 1997 Planned Program:**

- 4000 Procure 2000 non-developmental Item (NDI) rocket motors for qualification testing.
- 2200 Acquire AH-64 helicopter test articles and associated test hardware.
- 2397 Conduct airworthiness certification test flights from AH-64 helicopter.
- 215 Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 8812

Project D703

Page 27 of 28 Pages

Exhibit R-2 (PE 0603313A)

425

Item 37

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603313A Missile and Rocket Advanced Technology	D703	
FY 1998 Planned Program: Project not funded in FY 98.			
FY 1999 Planned Program: Project not funded in FY 99.			
<b>B. Project Change Summary</b>			
Previous President's Budget			
Appropriated Value			
Adjustments to Appropriated Value			
FY 1998 President's Budget Request			
Change Summary Explanation: Funding: This is a Congressionally mandated program.			
FY 1996		FY 1997	FY 1998
		8812	8812
		8812	
Project D703			
Exhibit R-2 (PE 0603313A)			

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603606A Landmine Warfare and Barrier

## Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25006	27629	19332	19778	19656	19249	20473	21065	Continuing	Continuing
D608 Countermine & Barrier Development	19312	22734	19332	19778	19656	19249	20473	21065	Continuing	Continuing
D624 Ground Penetrating Radar Technology	2850	4895	0	0	0	0	0	0	0	7745
D660 Land Mine Detection and Clearing	2844	0	0	0	0	0	0	0	0	2844

**Mission Description and Budget Item Justification:** This program element provides for the development and demonstration of countermine technologies, and a Congressional special interest effort to test and evaluate commercial technologies to support humanitarian demining operations. Advanced technology demonstrations (ATDs), advanced warfighting experiments, and modeling and simulation will be conducted to verify the system of systems approach, providing support for the shallow water/beach/land assault phase (Demo 1) of the Navy, Army, and USMC joint countermine advanced concept technology demonstration (ACTD). The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Breaching techniques will be developed for both conventional and electronically activated mines that can act at a distance. Operation Desert Storm and the humanitarian operations in Somalia have highlighted the need for new equipment to detect and neutralize land mines. The Army's highest priority requirements are in-stride detection and breaching, and man-portable stand-off and close-in detection and neutralization of landmines. Multi-sensor fusion will be used in vehicle-mounted mine detectors and airborne multispectral minefield detectors to sense surface-laid and buried mines. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weapons and ground vehicles. Work in this program element is related to and fully coordinated with PE 0603691A (Landmine Warfare and Barrier Advanced Development), PE 0602784A (Military Engineering Technology), PE 0602712A (Countermine Technology), and PE 0602709A (Night Vision and Electro-Optics Technology). This program is managed primarily by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA. This program is dedicated to conducting proof of principle field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603606A Landmine Warfare and Barrier

D608

## Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D608 Countermine & Barrier Development	19312	22734	19332	19778	19656	19249	20473	21065	Continuing	Continuing	Continuing

**A. Mission Description and Justification:** This project provides advanced technology demonstrations of countermine capabilities. The specific efforts include remote detection of minefields, detection of individual mines from moving vehicles and advanced hand held detectors, all of which must work against both traditional (metallic) mines and mines made from advanced materials. Multi-sensor fusion will be used in vehicle-mounted mine detectors and airborne multispectral minefield detectors to sense surface-laid and buried mines. Advanced signature projection and electronic deception techniques will be developed and demonstrated to defeat off-route, smart mines. A new generation of stand-off sensors and explosive/directed energy mine neutralization technologies will be integrated in a Mine Hunter/Killer that will be capable of detecting and destroying mines at maneuver speeds. These advanced technology demonstrations, along with advanced warfighting experiments and modeling and simulation represent key elements of the shallow water/beach/land assault phase of the Navy, Army, and USMC joint countermine advanced concept technology demonstration (ACTD).

## FY 1996 Accomplishments:

- 7633 - Successfully demonstrated off route smart mine clearance techniques to defeat terminal sensors of side attack mines;
  - Transitioned performance specifications and technical data to support limited procurement of side attack countermeasures for contingency operations.
- 11679 - Completed sensor fusion algorithms; initiated build and integration of hardware and software for vehicle mounted mine detector demonstration.
  - Conducted "expand the lodgment" and "beach break through" advanced warfighting demonstrations.
  - Completed phase I of joint countermine advanced concept technology demonstration (ACTD) modeling and simulation effort.
  - Completed procurement of multiple manportable, vehicle mounted, and airborne mine detection prototypes.
  - Defined countermine command, control, communications, computers, and intelligence (C4I) requirements and architecture and procured C4I equipment for Joint Countermine ACTD.

Total 19312

## FY 1997 Planned Program:

- 8247 - Conduct "movement to contact" countermine modeling and simulation studies and small scale countermine field experiments.
  - Complete simulation, analysis, and pre-demonstration exercises of countermine C4I architecture; conduct ACTD demonstration I at Camp Lejeune, NC in conjunction with United States Atlantic Command (USACOM) forces.
- 6215 - Complete development of forward looking infrared and down looking ground penetrating radar sensors for vehicular mounted mine detector.
  - Evaluate alternative multisensor approaches for vehicular mounted mine detector.

Project D608

Page 2 of 6 Pages

Exhibit R-2 (PE 0603606A)

428

Item 38

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603606A Landmine Warfare and Barrier Advanced Technology	D608	
<b>FY 1997 Planned Program (continued):</b>			
• 7717	- Initiate development efforts to improve maturity of vehicular mounted mine detector prototypes.		
	- Integrate forward looking sensor to one prototype to provide three systems with comparable capabilities.		
	- Implement sensor fusion of forward looking and down looking sensors on all three prototypes.		
• 555	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total	22734		
<b>FY 1998 Planned Program:</b>			
• 8735	- Conduct movement to contact Battle Lab experiment and assess contribution of new countermine technology to survivability of convoy/rear area assets.		
	- Analyze data from Joint Countermine ACTD Demo I, apply lessons learned to Demo II planning, and execute Demo II. Receive interim user report on novel system military suitability.		
	- Add fidelity to Joint Countermine ACTD novel system models and conduct sensitivity studies; complete modeling of false targets for detection systems and transition to joint countermine operational simulation. Continue validation and verification activities.		
• 3000	- Complete development of three vehicular mounted mine detector prototypes with alternative multisensor fusion design approaches, conduct comparative performance testing, and select system(s) for final technology demonstration.		
	- Transition program design and test documentation to Ground Stand-off Mine Detection System demonstration/validation.		
• 7597	- Complete fabrication of precision mine location, aimpoint estimator, fire control, and neutralization technologies for the Mine Hunter/Killer and complete plans for demonstration execution.		
	- Complete development of advanced stand-off ground penetrating radar (GPR) sensor to allow greater standoff mine detection distances and faster forward speeds. Fabricate prototype stand-off GPR for integration with Mine Hunter/Killer demonstrator.		
Total	19332		
<b>FY 1999 Planned Program:</b>			
• 7693	- Conduct Assault on Objective Battle Lab experiment and assess contribution of new countermine technology to survivability and mobility of assault forces.		
	- Analyze data from Joint Countermine ACTD Demo II, apply lessons learned to technology programs and provide support for residual hardware. Receive final user report on novel system military suitability.		
	- Develop models and simulations for Joint Countermine ACTD technologies and integrate into service models with new architecture; continue verification and validation.		

Project D608

Page 3 of 6 Pages

Exhibit R-2 (PE 0603606A)

429

Item 38

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603606A Landmine Warfare and Barrier

D608

## Advanced Technology

## FY 1999 Planned Program (continued):

- 12085 - Integrate prototype detection and neutralization technologies on Mine Hunter/Killer platform, complete contractor testing and complete site preparation for the Mine Hunter/Killer demonstration.
- Complete requirements analysis, definition of aircraft constraints and interfaces, and technology trade-offs for imaging multispectral airborne minefield detection system.

Total 19778

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
18251	15196	16386	14047
18820	22734		
+492			
19312	22734	19332	19778

Change Summary Explanation: Funding: FY 1997 - Congressional increase (+7538) for vehicular mounted mine detector.

FY 1998/FY 1999 - Funding increased in FY1998 (+2946) and FY1999 (+5731) to address high priority requirements for mine detection and neutralization.

Project D608

Page 4 of 6 Pages

Exhibit R-2 (PE 0603606A)

430

Item 38

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997																									
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT																										
3 - Advanced Technology Development		0603606A Landmine Warfare and Barrier Advanced Technology								D624																										
		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost																									
D624	Ground Penetrating Radar Technology	2850	4895	0	0	0	0	0	0	0	7745																									
<p><b>A. Mission Description and Justification:</b> This Congressional special interest program provides for the development and evaluation of stand-off ground penetrating radar (GPR) technologies for mine detection.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 2850 - Investigated detection algorithm and waveform improvements to stand-off ground penetrating radar technologies for manportable and vehicle mine detection applications.</li> </ul> <p>Total 2850</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 4775 - Test and evaluate detection algorithm enhancements and develop improved transmitter/receiver and waveform for stand-off GPR.</li> <li>• 120 - Transition stand-off GPR technologies to Mine Hunter/Killer ATD.</li> <li>• - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 4895</p> <p><b>FY 1998 Planned Program:</b> Project funded in PE 0603606A (Landmine Warfare and Barrier Advanced Technology) /D608.</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99.</p> <p><b>B. Project Change Summary</b></p> <table border="0"> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>2918</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>3000</td> <td>4895</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>-150</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2850</td> <td>4895</td> <td>0</td> <td>0</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997 funding provided by Congress (+4895) to support development of GPR technologies.</p>												FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	2918	0	0	0	Adjustments to Appropriated Value	3000	4895			FY 1998 Pres Bud Request	-150					2850	4895	0	0
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																																
Appropriated Value	2918	0	0	0																																
Adjustments to Appropriated Value	3000	4895																																		
FY 1998 Pres Bud Request	-150																																			
	2850	4895	0	0																																

Project D624

Page 5 of 6 Pages

Exhibit R-2 (PE 0603606A)

431

Item 38

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT  
D660

## 3 - Advanced Technology Development

0603606A Landmine Warfare and Barrier

## Advanced Technology

COST (in Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D660 Land Mine Detection and Clearing	2844	0	0	0	0	0	0	0	0	2844

**A. Mission Description and Justification:** This program provides for the integration and demonstration of commercial off-the-shelf technologies for use in humanitarian demining. This Congressional special interest program is a continuation of an effort funded in FY1995 under project D608 in PE 0603606A (Landmine Warfare and Barrier Advanced Technology). FY1997 funding for humanitarian demining technology is programmed in DoD PE 0603120D (Demining).

**FY 1996 Accomplishments:**

- 2844 - Developed and demonstrated commercial technologies for land mine detection and clearance in support of military support and sustainment operations.
- Completed development of multilingual mine awareness and training materials for instruction of host nation deminers.

Total 2844

FY 1997 Planned Program: Project not funded in FY 97.

FY 1998 Planned Program: Project not funded in FY 98.

FY 1999 Planned Program: Project not funded in FY 99.

**B. Project Change Summary**

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2918	0	0	0
3000			
-156			
2844	0	0	0

Project D660

Page 6 of 6 Pages

Exhibit R-2 (PE 0603606A)

432

Item 38

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603607A Joint Service Small Arms Program

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4516	9049	4754	5148	4977	5601	5955	6058	Continuing	Continuing
D627 Joint Service Small Arms Program (JSSAP)	4516	8070	4754	5148	4977	5601	5955	6058	Continuing	Continuing
D664 Advanced Lightweight Anti-Armor Weapon Sys	0	979	0	0	0	0	0	0	0	979

**Mission Description and Budget Item Justification:** The objective of this Program Element (PE) is to demonstrate key technologies leading to more effective small arms weapons and munitions for all Services. The Joint Services Small Arms Program (JSSAP) is designed to overcome the technological barriers associated with small arms/munitions/fire control for individual and crew-served weapons. The goal is to achieve substantial improvements in threat defeat under all environmental conditions while reducing the soldier's load. All JSSAP efforts are based upon approved Joint Service Science and Technology Objectives (JSSTO) and the Joint Service Small Arms Master Plan (JSSAMP), plus Mission Needs Statements and Operational Requirements Documents of the Services. The work in this PE is consistent with the resource constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. These programs are primarily managed by the U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Work in this PE is related to and fully coordinated with efforts in PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology), and transitions to JSSAP efforts conducted in PE 0604802A (Weapons and Munitions-Engineering Development) and PE 0604601A (Objective Crew Served Weapon-Engineering Development). Additional transition paths have been established in coordination with Product Manager (PM) Small Arms, USMC Program Manager (PM) Ground Weapons and US Special Operations Command (SOCOM). This program is dedicated to conducting proof of principle field demonstrations and tests of system-specific technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3.

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

BUDGET ACTIVITY		PE NUMBER AND TITLE								DATE	PROJECT
3 - Advanced Technology Development		0603607A Joint Service Small Arms Program								February 1997	D627
COST (In Thousands)	FY 1996 Actual	FY 1996 Estimate	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D627 Joint Service Small Arms Program (JSSAP)	4516	8070	4754	5148	4977	5601	5955	6058	Continuing	Continuing	
<p><b>A. Mission Description and Justification:</b> This project funds several efforts, including the following: (1) Objective Individual Combat Weapon (OICW) Advanced Technology Demonstration (ATD) which will provide a 300% to 500% increase in hit probability, the ability to defeat defilade or non-visible targets, and increase effective range to 1000 meters; (2) Objective Crew Served Weapon (OCSW), which will demonstrate the next generation crew-served weapon to replace selected M2 machine guns and MK19 grenade machine guns (GMG), a two-soldier portable system that maintains comparable firepower while featuring a 60-75% weight reduction; (3) multi-platform ballistic sight (MPBS), for an all weather day/night capability against materiel and personnel, increasing first burst hit probabilities from the present 15% to 90%; (4) 7.62mm long range sniper cartridge with enhanced effective range out to 1000m; (5) controlled penetration ammunition, intended to minimize collateral damage in confined operational environments; (6) training ammunition, to yield realistic training with a reduced maximum range of 2700m vs. 6500m for service ammunition; and (7) a new Joint service combat shotgun meeting the requirements of all the Services, increasing versatility, and reducing logistics burden.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>3944 - Demonstrated critical sub-system component technologies for OICW; integrated sub-system components for application into system prototypes, fully utilizing integrated product and process development methodology.</li> <li>572 - Completed technology demonstrations of multi-platform ballistic sight and prepared for transition.</li> <li>572 - Completed fabrication of hardware and verified performance of Cal .50 long range training ammunition (LRTA).</li> <li>572 - Fabricated/delivered refined low collateral damage rifle ammunition for performance verification.</li> <li>572 - Obtained Joint combat shotgun hardware and initiated technical tests.</li> <li>572 - Completed 7.62mm long range sniper cartridge performance verification, configuration documentation, and transition decision.</li> </ul> <p><b>Total</b> 4516</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>7200 - Refine/build/test/quality/exercise simulator for the OICW.</li> <li>7200 - Complete design and fabrication of OICW demonstrator weapons by two competitive contractor teams and conduct technology demonstration.</li> <li>7200 - Downselect to single OICW contractor team.</li> <li>688 - Verify low collateral rifle ammunition performance and produce final report.</li> <li>688 - Complete technical tests, complete operational test (OT) hardware, conduct OT tests and complete milestone decision for Joint combat shotgun.</li> <li>688 - Fabricate and demonstrate an initial prototype Objective Crew Served Weapon (OCSW).</li> <li>182 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs</li> </ul> <p><b>Total</b> 8070</p>											

Project D627

Page 2 of 4 Pages

Exhibit R-2 (PE 0603607A)

434

Item 39

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
<b>3 - Advanced Technology Development</b>	<b>0603607A Joint Service Small Arms Program</b>	<b>D627</b>																										
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3352 - Initiate and build complete hardware for OICW ATD.</li> <li>• 1402 - Complete initial OCSW demonstrator final prototype for safety/technical/user tests.</li> <li>- Conduct OCSW system performance demonstration at contractor's facility.</li> <li>- Deliver OCSW prototypes for government testing.</li> </ul> <p>Total 4754</p> <p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>• 3010 - Complete OICW ATD.</li> <li>- Transition OICW to PM Small Arms for EMD.</li> <li>• 2138 - Conduct safety/technical/user tests of OCSW prototype.</li> <li>- Evaluate OCSW system performance.</li> </ul> <p>Total 5148</p> <p><b>B. Project Change Summary</b></p> <table> <tr> <td>FY 1997 President's Budget</td> <td>FY 1996</td> <td>FY 1997</td> <td>FY 1998</td> <td>FY 1999</td> </tr> <tr> <td>Appropriated Value</td> <td>4365</td> <td>5243</td> <td>4756</td> <td>5152</td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>4487</td> <td>8070</td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>+29</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>4516</td> <td>8070</td> <td>4754</td> <td>5148</td> </tr> </table> <p>Change Summary Explanation: Funding: FY 1997 funds increased (+3000) for the Objective Individual Combat Weapon Program.</p>				FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999	Appropriated Value	4365	5243	4756	5152	Adjustments to Appropriated Value	4487	8070			FY 1998 Pres Bud Request	+29					4516	8070	4754	5148
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999																								
Appropriated Value	4365	5243	4756	5152																								
Adjustments to Appropriated Value	4487	8070																										
FY 1998 Pres Bud Request	+29																											
	4516	8070	4754	5148																								

Project D627

Page 3 of 4 Pages

Exhibit R-2 (PE 0603607A)

435

Item 39

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

0603607A Joint Service Small Arms Program

PROJECT

D664

## 3 - Advanced Technology Development

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D664 Advanced Lightweight Anti-Armor Weapon Sys	0	979	0	0	0	0	0	0	0	979

**A. Mission Description and Justification:** This Congressionally directed project calls for demonstration and evaluation of advanced warhead technologies that would significantly increase the individual soldier capability to attack light armored vehicles. The Army will competitively award a contract to develop and demonstrate 25mm anti-armor munitions suitable for use in the OCSW.

**FY 1996 Accomplishments:** Project not funded in FY 96.

**FY 1997 Planned Program:**

- 955 - Provide comparative data on shaped charge and explosively formed projectile warheads in order to assess the potential of meeting light armor penetration goals of the OCSW.
  - 24 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 979

**FY 1998 Planned Program:** Project not funded in FY 98.

**FY 1999 Planned Program:** Project not funded in FY 99

**B. Project Change Summary**

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

0

FY 1997

0

979

FY 1998

0

FY 1999

0

0

Change Summary Explanation: Funding: FY 1997 Congressional plus-up (+1000).

Project D664

Page 4 of 4 Pages

Exhibit R-2 (PE 0603607A)

436

Item 39

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603654A Line-of-Sight Technology

D460

Demonstration

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D460 LOSAT Technology Demonstration	13396	9791	13000	20000	40000	55000	67000	50000	10000	417923

**A. Mission Description and Budget Item Justification:** This program focuses on integration of the LOSAT weapon system into an air mobile configuration in order to help remedy the early entry force lethality shortfall against heavy armor. LOSAT is a mobile, direct fire, antitank system and provides overwhelming lethality with a high rate of kill at long range. The LOSAT weapon system consists of a kinetic energy (KE) missile launcher mounted on a Heavy High Mobility Multi-purpose Wheeled Vehicle (HMMWV) chassis. The current program provides for the conduct of a demonstration of the HMMWV platform and will involve flight tests and early soldier evaluations of the program. The demonstration program is a cost-effective means to assess the utility of LOSAT to the early entry force. Project objectives include transitioning from a technology demonstration program to an ACTD program in FY 1998 to position the technology for future acquisition decisions, demonstrate subsystem capabilities in flight tests and a dirty battlefield environment, evaluate the utility of the LOSAT technology for the early entry forces, demonstrate an integrated HMMWV-based LOSAT system in flight test and advanced warfighting experiments, and evaluate affordability issues. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan and Project Reliance. This program is dedicated to conducting proof of principal field demonstrations and tests of technologies to meet specific military needs and is therefore correctly placed in Budget Activity 3. Work on this program is conducted through the close combat anti-armor weapon system (CCAWS) Project Office in Huntsville, AL. The prime contractor is Lockheed Martin-Vought Systems in Dallas, TX.

**Acquisition Strategy:** The LOSAT weapon system provides the Army's early entry force an air mobile, leap-ahead technology, anti-tank weapon system providing overmatching armor lethality with no known countermeasures. The LOSAT KE missile and associated fire control system utilize unique and innovative technologies and resulted in a sole source development contract awarded to prime contractor Lockheed Martin-Vought Systems in Dallas, Texas. Funding in FY 1998 of \$13.0M supports the completion of the technology demonstration effort and the beginning of the ACTD program.

**FY 1996 Accomplishments:**

- 4344 - Completed AGS chassis fabrication/stopped work on AGS fire unit development effort.
- 7423 - Completed initial technical demonstration of LOSAT missile assembly and flight test.
- 1032 - Completed initial LOSAT/HMMWV feasibility and concept studies.
- 362 - Successfully conducted LOSAT/HMMWV launch effects test.
- 20 - Successfully conducted a C-130 roll-on/roll-off demonstration.
- 215 - Completed distributed interactive simulation crew station simulator (DISCSS) experiments.

Total 13396

Project D460

Page 1 of 3 Pages

Exhibit R-2 (PE 0603654A)

437

Item 40

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603654A Line-of-Sight Technology  
Demonstration

D460

## FY 1997 Planned Program:

- 157 - Conduct LOSAT/HMMWV early soldier evaluation at Fort Benning, GA (Infantry School).
- 1722 - Develop LOSAT weapon system performance requirements.
- 4104 - Define requirements/initiate missile electronics design/test including inertial measurement unit.
- 1151 - Prepare/conduct missile software requirements definition and analysis.
- 996 - Update LOSAT system simulation pertaining to the new missile guidance electronics.
- 1422 - Define requirements/initiate design of fire unit.
- 239 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 9791

## FY 1998 Planned Program:

- 1775 - Develop/test missile software.
- 2610 - Design/fabricate, missile hardware, conduct hardware-in-the-loop tests.
- 2390 - Initiate fire unit software development.
- 3615 - Continue fire unit analysis and design.
- 2610 - Continue missile analysis and design.

Total 13000

## FY 1999 Planned Program:

- 5525 - Continue development and test of fire unit/missile software.
- 4114 - Continue missile design/test, and initiate material purchases.
- 3535 - Continue fire unit design, test, and initiate material purchases.
- 1471 - Initiate hardware-in-the-loop/closed loop simulation evaluation/verification of new hardware/software design.
- 5355 - Initiate design/fabrication of prototype tooling and test equipment.

Total 20000

Project D460

Page 2 of 3 Pages

Exhibit R-2 (PE 0603654A)

438

Item 40

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)			DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603654A Line-of-Sight Technology Demonstration</b>		<b>D460</b>	
<b>B. Project Change Summary</b>	<b>FY 1996</b>	<b>FY 1997</b>	<b>FY 1998</b>	<b>FY 1999</b>
FY 1997 President's Budget	14384	18173	12998	0
Appropriated Value	14727	10000		
Adjustments to Appropriated Value	-1331	-209		
FY 1998 Pres Bud Request	13396	9791	13000	20000
Change Summary Explanation: Funding: FY 1997 - Funding reduced by Congress. Program restructured. FY 1999 - Funds are provided for the continuation of the ACTD program initiated in FY 1998.				

Project D460

Page 3 of 3 Pages

Exhibit R-2 (PE 0603654A)

439

Item 40

UNCLASSIFIED

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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE  
February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603710A Night Vision Advanced Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	31142	29761	19299	19250	37651	33487	33135	29516	Continuing	Continuing
DK70 Night Vision Advanced Technology	14295	11186	4821	9652	14465	15669	14458	13639	Continuing	Continuing
DK86 Night Vision, Airborne Systems	8919	5450	8336	9003	11782	7468	11091	8661	Continuing	Continuing
DK87 Night Vision, Combat Vehicles	7928	10947	4861	0	11404	10350	7586	7216	Continuing	Continuing
DC63 TRACTOR QUAKE	0	2178	1281	595	0	0	0	0	0	4054

**Mission Description and Budget Item Justification:** This program element (PE) develops new and improved tactical night vision and electronic sensor technologies for surveillance, target acquisition, pilotage driving, and to meet future requirements of infantry, anti-armor, air defense, combat vehicle, aircraft, and unmanned vehicle applications. This technology will provide the capability to acquire and engage hostile targets at extended ranges during day/night, smoke, obscured weather and battlefield conditions, significantly enhancing the warfighting capability and survivability of U.S. systems. Multisensor target acquisition suites will be demonstrated to provide rapid automatic acquisition of targets and battlefield intelligence data to allow U.S. forces to operate and react well within the operational timelines of threat forces. Multispectral and hyperspectral sensors will provide the capability to detect obscured, concealed, and reduced signature threats. Efforts are also directed toward technology for wide field-of-view (FOV) sensors to support dismounted soldier mobility and day/night nap-of-the-earth pilotage at high speeds. This PE will provide the target acquisition sensor technology options for advanced ground and airborne vehicle requirements, Rapid Force Projection Initiative (RFPI), and air defense platforms. Technology advances achieved under this PE have tri-service applications. Work in this program element is consistent with the resource-constrained Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance agreements on sensors and electronic devices with oversight and coordination provided by the Joint Directors of Laboratories. This work is related to and fully coordinated with efforts in PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602270A (Electronic Warfare Technology), PE 0603774A (Night Vision Systems Advanced Development), and PE 0604710A (Night Vision Systems Engineering Development). There is no unnecessary duplication of effort within the Army or DoD. Work in this PE is primarily managed by the US Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Ft. Monmouth, NJ. Contractors include: Texas Instruments, Inc., Dallas, TX; Hughes Aircraft Co., El Segundo, CA; Fibertek, Herndon, VA; Questech, Falls Church, VA; Northrop-Grumman, Linthicum, MD; Lockheed-Martin Corp., Orlando, FL; Lockheed-Martin, Lexington, MA; Alliant, Hopkins, MN; EOIR, Spotsylvania, VA; Booze-Allen, McLean, VA; Omar McCall, Beltsville, MD. This project includes advanced technology demonstrations and tests of technologies to meet specific military needs and is therefore appropriately placed in Budget Activity 3.

Page 1 of 7 Pages

Exhibit R-2 (PE 0603710A)

440

Item 41

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

## 0603710A Night Vision Advanced Technology

PROJECT

DK70

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK70 Night Vision Advanced Technology	14295	11186	4821	9652	14465	15669	14458	13639	Continuing	Continuing

**A. Mission Description and Justification:** This project will develop and demonstrate high performance, sensor/multisensor technology to meet the target servicing requirement for weapon systems upgrades. Hunter Sensor Suite advanced technology demonstration (ATD) will demonstrate the feasibility of a lightweight, deployable and survivable hunter vehicle platform with an advanced, low observable, long range hunter sensor suite in the Rapid Force Projection Initiative advanced concept technology demonstration (RFPI ACTD). The Hunter Sensor Suite will combine second generation thermal imaging, day TV, eye safe laser rangefinder, embedded aided target recognition, and image compression/transfer technology. Remote Sentry ATD will demonstrate a compact, lightweight, integrated multisensor system capable of being implanted in forward areas and behind enemy lines to provide day/night, adverse weather, unmanned surveillance and targeting information in the Rapid Force Projection Initiative (RFPI) ACTD. Multi-function staring sensor technology demonstration will demonstrate a modular reconfigurable sensor suite that integrates multiple advanced sensor components including large format staring infrared arrays, multi-function laser and acoustic arrays. This technology demonstration will provide ground combat and amphibious assault vehicles with compact affordable sensor options for long range non-cooperative target recognition, mortar/sniper fire location and air defense against low signature UAV's and long range helicopters.

## FY 1996 Accomplishments:

- 14295 - Integrated the interim Hunter Sensor Suite (without aided target recognition) on the hunter surrogate vehicle; delivered interim unit for Task Force XXI Army warfighting experiment (AWE).
- Completed development of Hunter Sensor Suite aided target recognition system.
- Fabricated "cheap suit" signature management appliqué and integrated "cheap suit" onto the hunter surrogate vehicle.
- Completed integration and demonstrated Remote Sentry ATD hardware.

Total 14295

## FY 1997 Planned Program:

- 10960 - Integrate aided target recognition (ATR) processor and automated command and control system with baseline Hunter Sensor Suite and vehicle; integrate with Remote Sentry, Rapid Force Projection Initiative (RFPI) command and control (C2) network, and RFPI weapons; conduct engineering tests to verify ATR and C2 performance; deliver sensor/vehicle system to RFPI ACTD.
- 226 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 11186

Project DK70

Page 2 of 7 Pages

Exhibit R-2 (PE 0603710A)

441

Item 41

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603710A Night Vision Advanced Technology

DK70

## FY 1998 Planned Program:

- 4821 - Initiate component risk reduction for multifunction staring sensor demonstration, and develop reconfigurable sensor backplane that fully integrates aperture, power, and signal processing requirements for multiple platform applications.

Total 4821

## FY 1999 Planned Program:

- 9652 - Complete design of multifunction sensor demonstration including large format, high speed mid-wave infrared (MWIR) staring array which may be capable of being reconfigured to be visible through either 5 micron or 8-12 micron operation.

Total 9652

## B. Project Change Summary

FY 1997 President's Budget	FY 1996	FY 1997	FY 1998	FY 1999
Appropriated Value	14624	11425	6321	14110
Adjustments to Appropriated Value	15035	11186		
FY1998 Pres Bud Request	-740			
	14295	11186	4821	9652

Change Summary Explanation: Funding: FY 1998- Funding reprogrammed (-1500) to higher priority requirements.  
 Funding: FY 1999- Funding reprogrammed (-4458) to higher priority requirements.

Project DK70

Page 3 of 7 Pages

Exhibit R-2 (PE 0603710A)

442

Item 41

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603710A Night Vision Advanced Technology								DK86	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK86	Night Vision, Airborne Systems	8919	5450	8336	9003	11782	7468	11091	8661	Continuing	Continuing

**A. Mission Description and Justification:** This project concentrates on the development and flight evaluation of night pilotage technology, imaging sensor and display technology, and automated obstacle warning technology to meet the requirements of future aviation platforms, and to enhance the operational capabilities and survivability of currently fielded attack, scout, cargo and utility helicopters. This technology will significantly enhance the survivability of Army aviation assets by permitting rotorcraft to fly at nap-of-the-earth (NOE) altitude and avoid obstacles in day/night/adverse weather conditions; and reduce exposure to air defense artillery, surveillance systems, and smart missiles. Technology includes high-performance multi-sensor pilotage technology and single-sensor advanced image intensification (AI2) technology for lower-cost applications. The advanced helicopter pilotage (AHP) demonstration will provide, in both demonstration hardware and flight evaluation, a high-quality dual-spectral pilotage sensor with the field of view and resolution required for advanced aircraft, and the displays needed to provide this imagery to the pilot. The advanced image intensification (AI2) technology demonstration provides an improved night vision goggle capability with higher resolution, larger field of view, and integrated symbology. It will demonstrate technology for applications where an advanced, dual-spectrum sensor is not affordable, but additional capability over existing goggles is needed. These applications include utility and cargo aircraft, and the mounted and dismounted soldier. The aerial scout sensor suite will provide non-line-of-sight targeting for weapons systems in the RFPI ACTD and provide options for airborne surveillance applications, including potential upgrades to the future tactical unmanned aerial vehicles (UAV). The air/land enhanced reconnaissance and targeting (ALERT) demonstration builds on the multisensor aided targeting (MSAT)-air program, which demonstrated an aided target recognition (ATR) capability for hovering helicopters. ALERT will demonstrate search on-the-move aided target acquisition using a FLIR/laser sensor suite for future aviation assets. Technology developed under this project is also directly applicable to the night flying requirements of the other services and Special Operations Command's rotary wing aircraft.

**FY 1996 Accomplishments:**

- 8919 - Developed and integrated a wide field of view (FOV) (40 x 80 deg) dual spectrum (FLIR and I2) pilotage sensor technology to provide significant reduction in pilot workload.
- Conducted AI2 advanced warfighting demo with the user; provided transition option to program manager.
- Designed and developed aerial scout sensor technology that will provide non-line of sight targeting, over-the-hill battlefield reconnaissance surveillance, and battlefield assessment. Candidate sensors included staring FLIR, MTI radar and wide area infrared (IR) lines scanner.

Total 8919

Project DK86

Page 4 of 7 Pages

Exhibit R-2 (PE 0603710A)

443

Item 41

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
<b>3 - Advanced Technology Development</b>	<b>0603710A Night Vision Advanced Technology</b>	<b>DK86</b>	
<b>FY 1997 Planned Program:</b>			
• 5343	- Demonstrate wide-FOV night pilotage system-helmet mounted display system and dual spectrum (FLIR and I2) sensors in a single turret.		
	- Complete evaluation of candidate aerial scout sensors and begin integration on aerial platform.		
• 107	- Initiate ALERT ATD to develop on-the-move aided target recognition using 2nd Gen FLIR and multimode laser.		
• 5450	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.		
Total	5450		
<b>FY 1998 Planned Program:</b>			
• 8336	- Demonstrate ultra-wide FOV (40° X 80°) night pilotage system (helmet mounted display system and dual spectrum (IR and I <sup>2</sup> ) sensors in a single turret) to provide a significant reduction in pilot cognitive and physical work load.		
	- Complete integration of aerial scout sensor aircraft, complete ATR modifications to ground station, conduct performance testing and deliver to the RFPI ACTD.		
	- Establish baseline airborne FLIR ATR performance for on-the-move target detection and recognition.		
Total	8336		
<b>FY 1999 Planned Program:</b>			
• 9003	- Develop approach for common module tactical UAV sensor payload and initiate preliminary design of lightweight multispectral and IR sensors.		
	- Complete algorithm upgrades to the ALERT ATR and sensor suite and evaluate improvement over baseline on-the-move target detection and recognition.		
	- Initiate development of multimode laser to provide range data and target profile information to the ALERT ATR.		
Total	9003		
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	9128	7766	13365
Adjustments to Appropriated Value	9383	5450	15327
FY 1998 Pres Bud Request	-464		
	8919	5450	8336
			9003
Change Summary Explanation: Funding:			
FY 1997- Congressional reduction for aerial scout sensors.			
FY 1998- Funding reprogrammed (-5029) to higher priority requirements.			
FY 1999- Funding reprogrammed (-6324) to higher priority requirements			

Project DK86

Page 5 of 7 Pages

Exhibit R-2 (PE 0603710A)

444

Item 41

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603710A Night Vision Advanced Technology								DK87	
	COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DK87	Night Vision, Combat Vehicles	7928	10947	4861	0	11404	10350	7586	7216	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project demonstrates target acquisition sensor technology to meet the stringent target acquisition requirements of future combat vehicles. Target Acquisition ATD will demonstrate an extended range, multisensor target acquisition suite for future tank, cavalry, and scout vehicles. The target acquisition multisensor suite will consist of a second generation thermal imaging sight with automated wide area search and aided target recognition, a low cost millimeter wave (MMW) ground radar and a multifunction laser. Electronic integrated sensor suite for air defense will demonstrate technology for the maneuver force with passive, automated volume search, target detection, tracking and identification, and low probability of intercept laser ranging of fixed wing, rotary, and cruise missile aircraft. Multifunction staring sensor technology demonstration will demonstrate a modular reconfigurable sensor suite that integrates multiple advanced sensor components including large format staring infrared arrays, multi-function laser and acoustic arrays.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>7928 - Integrated the target acquisition ATD processor and sensor suite. Demonstrated and baselined the target acquisition sensor suite for performance.</li> <li>- Demonstrated millimeter wave (MMW) ground radar and multi-wavelength multi-function laser.</li> <li>- Completed electronic integrated sensor suite (EISS) data collection and algorithm enhancements, and single band/single aperture trade studies.</li> </ul> <p>Total 7928</p> <p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>10715 - Demonstrate target acquisition multifunction laser and automatic target cueing as a potential upgrade to the M1A2, and demonstrate MTI radar to provide long-range, adverse-weather target cueing.</li> <li>- Provide field demonstration support and test data analysis in support of Phase I RFPI acoustic test program.</li> <li>- Complete static demonstrations of alternative passive sensor (acoustic and infrared search and track) technologies to support forward areas air defense system upgrades.</li> <li>232 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 10947</p> <p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>3361 - Modify M1A2 commander's independent thermal viewer with multifunction laser and gimbal scan; integrate with MMW radar and demonstrate multisensor ATR for the Future Main Battle Tank.</li> <li>- Provide field demonstration support and test data analysis in support of Phase II RFPI acoustic test program.</li> </ul>											

Project DK87

Page 6 of 7 Pages

Exhibit R-2 (PE 0603710A)

445

Item 41

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603710A Night Vision Advanced Technology

DK87

## FY 1998 Planned Program: (continued)

- Conduct limited, on-the-move testing of alternative passive sensor (acoustic and infrared search and track) technologies to support forward area air defense system upgrades.

- 1500 - Define interfaces and size/weight/power constraints to allow future integration of multifunction sensor suite with a combat vehicle testbed.

Total 4861

## FY 1999 Planned Program: Project not funded in FY 99.

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>
9130	11182	4855	6548
9385	10947		
-1457			
7928	10947	4861	0

Change Summary Explanation: Funding: FY 1996- Funding reprogrammed (-1457) to higher priority requirements.

FY 1999- Funding reprogrammed (-6548) to higher priority requirements.

Project DK87

Page 7 of 7 Pages

Exhibit R-2 (PE 0603710A)

446

Item 41

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY											
3 - Advanced Technology Development											
PE NUMBER AND TITLE											
0603734A Military Engineering Advanced Technology											
COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	14544	20213	12231	17334	16431	5444	4962	3775	Continuing	Continuing	
DT08 Combat Engineering Systems	2330	1426	1663	2988	3904	5444	4962	3775	Continuing	Continuing	
DT10 Total Distribution Advanced Technology Demonstration	12214	9384	0	0	0	0	0	0	0	21598	
DT12 Rapid Terrain Visualization	0	9403	10568	14346	12527	0	0	0	0	46844	

**Mission Description and Budget Item Justification:** This program encompasses demonstrations of technologies that provide the capabilities required for the engineer and logistician to successfully plan, rehearse and execute missions in support of the commander and the force projection Army. Critical deficiencies exist in the Army's ability to rapidly acquire, update, maintain and distribute terrain data in support of both terrain and battlefield visualization; to apply physics-based reasoning to planning and executing mobility, counter-mobility, survivability, and general engineering missions; to conduct logistics-over-the-shore operations in adverse sea states; to establish in-transit visibility of materiel and supplies; and to manage logistics distribution and logistics automation. The demonstration projects in this program element focus on the technologies required to correct these critical deficiencies. Capabilities demonstrated will be applicable to missions at all echelons within the force structure during either combat operations or operations other than war. Demonstrations are integral components of Army Advanced Warfighting Experiments, Advanced Concept Technology Demonstrations, other Advanced Technology Demonstrations, and joint field training exercises. Emphasis is placed on rapid transition of technologies into Command and Control (C2) systems, combat/war models and simulations or simulators. This provides shared situational awareness, common representation of terrain and consistent predictions or assessments of mobility, counter-mobility, survivability, and logistics missions in the linkage of C2 systems, models, and simulations being developed by the Army to exploit information technologies. The work in this program element is consistent with the Army Science and Technology Master Plan, the Training and Doctrine Command (TRADOC) Battlefield Visualization Concept, the Office of the Deputy Chief of Staff, Operations (ODCSOPS) Battlefield Visualization Objectives, the Army Modernization Plan, and Project Reliance. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is properly placed in Budget Activity 3.

UNCLASSIFIED



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## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

## 3 - Advanced Technology Development

PE NUMBER AND TITLE

0603734A Military Engineering Advanced  
Technology

PROJECT

DT08

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT08 Combat Engineering Systems	2330	1426	1663	2988	3904	5444	4962	3775	Continuing	Continuing

**A. Mission Description and Justification:** This project will demonstrate decision support applications for mobility, countermobility and survivability that support multiple battlefield operating systems, including maneuver, command and control, and mobility and survivability. An integrated obstacle planning and simplified survivability assessment system will be demonstrated in brigade and division level exercises. This software suite will enable the engineer to rapidly generate engineer assessments, conduct course of action analyses, provide engineer force level information to commanders and other staff/functional elements, and provide the engineer with the ability to effectively execute command and control of the complex battlefield missions of countermobility and survivability. This project will also demonstrate at full scale a capability to conduct logistics-over-the-shore (LOTS) operations at sea state 3; this will greatly increase LOTS throughput of equipment and supplies from ship to shore, and significantly reduce the time and materials required to establish linkages between LOTS sites and the inland transportation infrastructure. Present LOTS operations are limited to sea state 2 or less; this is an unacceptable limitation to force projection. A complete engineering design of a full-scale Rapidly Installed Breakwater System (RIBS) will be developed based on detailed engineering analyses, laboratory, and 1/4-scale field tests. A full-scale demonstration of RIBS that reduces waves conditions from the lower range of sea state 4 by 50 percent will be performed. Evaluations of the full-scale deployability, transporability, mooring loads, structural integrity, and potential of RIBS for storm survival will be conducted. The capability to rapidly and, with minimum logistics burdens and reduced engineer equipment, stabilize beach sands and soft soils for roads, material storage areas, heliports, and other horizontal operating surfaces associated with LOTS operations will be demonstrated. Transition targets for the software capabilities that will be integrated and demonstrated under this project include the Army Battle Command System (ABCS) and the Digital Topographic Support System (DTSS). The work is performed by the Cold Regions Research and Engineering Laboratory, Hanover, NH, and the Waterways Experiment Station, Vicksburg, MS.

## FY 1996 Accomplishments:

- 2005 - Demonstrated integrated database generation and update capabilities in support of early entry forces.
- Developed and demonstrated version 1.0 of mobility and survivability software suite at Prairie Warrior 96.
- 325 - Integrated, demonstrated, and transitioned task force level decision support applications for countermobility and survivability to the Fort Hood experimental force.

Total 2330

Project DT08

Page 2 of 8 Pages

Exhibit R-2 (PE 0603734A)

448

Item 42

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603734A Military Engineering Advanced Technology

DT08

## FY 1997 Planned Program:

- 1391 - Upgrade mobility and survivability software to version 1.5 through inclusion of wide area munition effectiveness, military hydrology, and excavation in frozen soils algorithms, and initiate implementation of automated obstacle planning.
- Demonstrate mobility and survivability version 1.5 at Prairie Warrior 97.
- 35 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 1426

## FY 1998 Planned Program:

- 1663 - Provide final verification and integrate algorithms into mobility and survivability battlefield operating system software.
- Demonstrate mobility and survivability battlefield operating system software during Ulchi Focus Lens in Korea to verify world-wide planning capabilities.
- Conduct demonstrations to validate engineer resource allocation algorithms during Division XXI exercise.

Total 1663

## FY 1999 Planned Program:

- 2988 - Establish and verify structural requirements for sea-worthiness of full-scale Rapidly Installed Breakwater System to attenuate adverse sea-states for logistics-over-the-shore operations.
- Determine and validate sea-state 3 mooring requirements for Rapidly Installed Breakwater System (RIBS); finalize design of full-scale RIBS.
- Acquisition of geotechnical materials, site selection, and site preparation for FY 2000 demonstration of beach sand stabilization technologies.

Total 2988

## B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
2834	1456	1654	482
2913	1426		
-583			
2330	1426	1663	2988

Change Summary Explanation: Funding: FY 1996 - funds reprogrammed (-433) to higher priority requirements; undistributed Congressional reductions and rescissions (-71).

FY 1999 - Project increased (+2506) for LOTS Advanced Technology Demonstration .

Project DT08

Page 3 of 8 Pages

Exhibit R-2 (PE 0603734A)

449

Item 42

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603734A Military Engineering Advanced Technology

DT10

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT10 Total Distribution Advanced Technology Demonstration	12214	9384	0	0	0	0	0	0	0	21598

**A. Mission Description and Justification:** Operation Desert Storm showed that the logistics distribution system needed major improvements to increase its efficiency and effectiveness. The Total Distribution Advanced Technology Demonstration (TDATD) was established to demonstrate potential enhancements in logistics situational awareness and course of action analyses supporting distribution management, in-transit asset visibility and logistics automation and communication. The TDATD will demonstrate automated logistics planning tools, computer simulation and modeling techniques, advanced microelectronics, satellite tracking and communications technology to support an advanced objective logistics supply capability. These tools will be demonstrated within the context of an integrated suite of logistics data management tools, decision support tools, and collaborative planning tools. The work is being performed by: the Communications Electronics Research Development and Engineering Center, Ft. Monmouth, NJ; the Army Research Laboratory, Aberdeen Proving Ground, MD; the Waterways Experimentation Station, Vicksburg, MS; and the Topographic Engineering Center, Alexandria, VA.

## FY 1996 Accomplishments:

- 5095 - Developed expanded Logistics Anchor Desk (LAD) connectivity to real logistics data sources i.e. the Standard Army Management Information Systems (STAMIS) and additional classes of supply.
    - Developed and integrated enhanced infrastructure and terrain visualization capabilities and data such as engineer data and road/port data.
    - Developed a simulation capability for additional Cost and Operational Analysis (COA) to include machine learning and knowledge discovery and expanded data visualization in the LAD.
  - 3882 - Developed interfaces into the Combat Service Support Control System/Army Global Command and Control System (CSSCS/AGCCS) architecture in a client-server based relationship while providing technology options for these systems.
    - Developed links and provided the warfighting commanders with enhanced leave-behind logistics automation capabilities through participation in Advanced Warfighting Experiments (AWEs) such as Prairie Warrior and Unified Endeavor.
  - 3237 - HQ AMC support to Joint Logistics Advanced Concept Technology Demonstration (ACTD).
- Total 12214

## FY 1997 Planned Program:

- 4680 - Complete development of expanded LAD connectivity to real logistics data sources by incorporating automated data management and other data integrity utilities.
- 4475 - Develop enhanced LAD COA and logistics automation and infrastructure assessment capabilities using sensitivity analysis and total COA analysis.
- - Transition advanced LAD capabilities into the CSSCS/AGCCS architecture to provide these systems improved logistics capabilities.

Project DT10

Page 4 of 8 Pages

Exhibit R-2 (PE 0603734A)

450

Item 42

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997																									
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT																										
3 - Advanced Technology Development	0603734A Military Engineering Advanced Technology	DT10																										
<p><b>FY 1997 Planned Program: (continued)</b></p> <ul style="list-style-type: none"> <li>- Insert enhanced LAD COA technology into leave-behind logistics automation capabilities that are fully integrated into the AGCCS and the Global Command and Control Systems (GCCS) for the warfighting CINCs.</li> <li>- Demonstrate LAD capabilities integrated within the common architecture in Prairie Warrior and Task Force XXI.</li> <li>229 - Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 9384</p> <p><b>FY 1998 Planned Program:</b> Project not funded in FY 98</p> <p><b>FY 1999 Planned Program:</b> Project not funded in FY 99</p> <p><b>B. Project Change Summary</b></p> <table border="1"> <thead> <tr> <th></th> <th>FY 1996</th> <th>FY 1997</th> <th>FY 1998</th> <th>FY 1999</th> </tr> </thead> <tbody> <tr> <td>FY 1997 President's Budget</td> <td>9207</td> <td>9585</td> <td>0</td> <td>0</td> </tr> <tr> <td>Appropriated Value</td> <td>9467</td> <td>9384</td> <td></td> <td></td> </tr> <tr> <td>Adjustments to Appropriated Value</td> <td>+2747</td> <td></td> <td></td> <td></td> </tr> <tr> <td>FY 1998 Pres Bud Request</td> <td>12214</td> <td>9384</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>Change Summary Explanation: Funding: FY 1996 - funds reprogrammed into this project for Joint Logistics ACTD.</p>					FY 1996	FY 1997	FY 1998	FY 1999	FY 1997 President's Budget	9207	9585	0	0	Appropriated Value	9467	9384			Adjustments to Appropriated Value	+2747				FY 1998 Pres Bud Request	12214	9384	0	0
	FY 1996	FY 1997	FY 1998	FY 1999																								
FY 1997 President's Budget	9207	9585	0	0																								
Appropriated Value	9467	9384																										
Adjustments to Appropriated Value	+2747																											
FY 1998 Pres Bud Request	12214	9384	0	0																								

Project DT10

Page 5 of 8 Pages

Exhibit R-2 (PE 0603734A)

451

Item 42

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603734A Military Engineering Advanced

DT12

Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
DT12 Rapid Terrain Visualization	0	9403	10568	14346	12527	0	0	0	0	46844

**A. Mission Description and Justification:** This project will demonstrate the integration of critical battlefield visualization technologies in support of crisis response and force projection missions to enable the Joint Warfighter to successfully plan, rehearse and execute his mission. Digital Topographic Data (DTD) are the foundation for battlefield visualization and these data are not currently available for most areas where Force XXI units will operate. Methods for rapidly producing DTD to support military operations, particularly early entry, and the optimum resolution and format of digital terrain data for both current and notional systems need to be established. The Rapid Terrain Visualization (RTV) (formerly Rapid Battlefield Visualization) Advanced Concept Technology Demonstration (ACTD) will be conducted to demonstrate capabilities to rapidly collect source data and generate high resolution digital terrain databases to support crisis response and force projection operations within the timelines required by the joint force commander. The RTV ACTD will also demonstrate capabilities for the commander to integrate these terrain databases with current situation data, and manipulate and display the integrated databases to determine how to achieve his objectives, and visualize the desired end state. A capability for rapid collection of high resolution (up to 1-meter grid spacing) digital terrain elevation data will be demonstrated, and imagery from aircraft and satellite platforms will be used to generate terrain feature data and map backgrounds. The RTV ACTD will provide and leave behind computer workstations and applications software to generate high resolution terrain databases, to evaluate courses of action using mission planning and embedded wargaming software, and to support mission rehearsals. This ACTD will also provide a tool for further exploration of emerging warfighting concepts and doctrine. The ACTD will leverage the Defense Advanced Research Projects Agency (DARPA) Battlefield Awareness and Data Dissemination ACTD for data dissemination over the global broadcast system and tactical communications, and the Communications and Electronics Command (CECOM) Battlespace Command and Control (BC2) Advanced Technology Demonstration for workstations and applications software. This project is cooperatively executed with and will leverage work in progress by: the Topographic Engineering Center (TEC); National Imagery and Mapping Agency (NIMA); National Reconnaissance Office (NRO); Defense Airborne Reconnaissance Office (DARO); and the Defense Modeling and Simulation Office (PEO-IEW), Ft. Belvoir, VA. Contractors include: the Joint Precision Strike Demonstration (JPSD) Office, Program Executive Officer, Intelligence and Electronic Warfare (PEO-IEW), Ft. Belvoir, VA. Contractors include: Raytheon, Bedford, MA; SAIC, Rosslyn, VA; MRJ, Oakton, VA; TASC, McLean, VA; EO-IR Measurements, Spottsylvania, VA; Space Applications Corp, Vienna, VA; and MTC, Shrewsbury, NJ. Participating government laboratories include: Topographic Engineering Center, Alexandria, VA; Army Research Laboratory, Adelphi, MD; Communications and Electronics Research, Development and Engineering Center, Ft. Monmouth, NJ.

**FY 1996 Accomplishments:** Program not funded. Initial planning for the Rapid Terrain Visualization (RTV) ACTD was completed under PE 0603238A (Air Defense/Precision Strike Technology)/ Project D177.

Project DT12

Page 6 of 8 Pages

Exhibit R-2 (PE 0603734A)

452

Item 42

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603734A Military Engineering Advanced Technology

PROJECT

DT12

## FY 1997 Planned Program:

- 5653 - Establish contract with industry to integrate technologies needed to configure a system to acquire and process high resolution digital terrain elevation data within tactically significant timelines..
  - Generate feature data of XVIII Airborne Corps (ABC) Area Of Interest (AOI) using advanced, semi-automated terrain feature extraction software and create tailored databases for visualization workstations.
  - Integrate C4I systems (e.g., the All Source Analysis System and the Maneuver Control System) with visualization systems to enable common representation of friendly and threat force location and strength.
  - 3530 - Demonstrate rapid battlefield visualization capability in JPSD Integration and Evaluation Center (IEC) and measure effectiveness of various RTV system configurations.
  - Evaluate military utility of RTV technologies and develop concepts of operations during XVIII ABC Advanced Warfighting Experiments (AWEs).
  - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
- Total 220 9403

## FY 1998 Planned Program:

- 5056 - Conduct proof-of-concept data collection of high resolution digital elevation data sets to support the XVIII ABC AWE .
  - Merge multi-resolution elevation and feature data into a fully integrated data set using prototype battlefield visualization database generation systems and generate tailored databases for visualization workstations.
  - 5512 - Develop capability to integrate live feeds from intelligent sensor systems into RTV mission planning workstation in near-real-time.
  - Demonstrate integrated RTV systems in JPSD IEC and obtain data to evaluate measures of effectiveness.
  - Participate in the XVIII ABC AWEs and TF-XXI Division AWE.
- Total 10568

## FY1999 Planned Program:

- 6155 - Acquire and process high resolution digital elevation data set in direct support of an XVIII ABC AWE.
  - Exploit multi-spectral and hyperspectral imagery to accelerate the terrain feature extraction process using the prototype RTV database generation system.
  - 8191 - Extend RTV capability from Corps level to selected XVIII Airborne Corps Division elements.
  - Demonstrate end-to-end RTV process in the IEC including results of rapid data collection and live feeds to XVIII Airborne Corps.
  - Initiate upgrade of workstations and software at XVIII Airborne Corps to objective configuration and use in AWEs.
- Total 14346

Project DT12

Page 7 of 8 Pages

Exhibit R-2 (PE 0603734A)

453

Item 42

UNCLASSIFIED



UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
3 - Advanced Technology Development	0603734A Military Engineering Advanced Technology		DT12
<b>B. Project Change Summary</b>			
FY 1997 President's Budget	FY 1996	FY 1997	FY 1998
Appropriated Value	0	9623	10591
Adjustments to Appropriated Value		9403	14392
FY 1998 Pres Bud Request	0	9403	10568
			14346

Project DT12

Page 8 of 8 Pages

Exhibit R-2 (PE 0603734A)

Item 42

454

UNCLASSIFIED

## UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

## BUDGET ACTIVITY

## PE NUMBER AND TITLE

## 3 - Advanced Technology Development

0603772A Advanced Tactical Computer Science  
and Sensor Technology

COST (In Thousands)	FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	27185	21282	19970	23079	23810	21573	22453	23578	Continuing	Continuing
D101 Tactical Automation	17436	13430	12745	17317	17124	15418	15729	16566	Continuing	Continuing
D243 Sensors and Signal Processing	3125	955	3863	5762	6686	6155	6724	7012	Continuing	Continuing
D281 Ground Combat Identification Demonstrations	6624	6897	3362	0	0	0	0	0	0	25865

**Mission Description and Budget Item Justification:** This program element supports projects that provide advanced computer science and technology solutions to command and control (C2), data correlation, tactical surveillance, and combat identification problems. Specifically, this program addresses solutions to integration of the battlefield, synchronization of combined arms forces, synchronization of joint forces, C2 on the move, correlation of intelligence data from airborne and space based sensors, integrated situation awareness (SA), battlefield combat identification (CI), point of engagement identification (ID) approaches to reduce fratricide for ground forces, unmanned air vehicle surveillance, and hostile weapons location. Work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and Project Reliance. It is related to and fully coordinated with efforts in PE 0602783A (Computer and Software Technology), PE 0602782A (Command, Control and Communications Technology), PE 0603006A (Command, Control and Communications Advanced Technology), PE 0602709A (Night Vision Technology), PE 0603710A (Night Vision Advanced Technology), and PE 0602120A (Electronic Surveillance and Fuzing Technology) in accordance with the ongoing Reliance joint planning process. Work is performed primarily by the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC), Command/Control and Systems Integration Directorate (C2SID), Ft Monmouth, NJ, Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA and Intelligence Electronic Warfare Directorate (IEWD), Vint Hill Farms Station, Warrenton, VA. Project D281 is managed by Project Manager, Combat Identification, Alexandria, VA and Fort Monmouth, NJ. This program is dedicated to conducting field demonstrations and tests of technologies to meet specific military needs and is therefore properly placed in Budget Activity 3.

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BUDGET ACTIVITY		RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE		February 1997		PROJECT			
3 - Advanced Technology Development		PE NUMBER AND TITLE		0603772A Advanced Tactical Computer Science and Sensor Technology		D101		D101			
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D101 Tactical Automation		17436	13430	12745	17317	17124	15418	15729	16566	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This is the Army's major science and technology program to provide the architecture and products to implement the digitized battlefield which is essential to winning the "Information War". It develops advanced computer science and technology solutions of Army-unique command and control deficiencies in the area of combined arms operations. Specifically, this project addresses solutions for digital information transfer and display for horizontal integration of the battlefield, synchronization of Combined and Joint Forces, command and control (C2) on the move, integrated situation awareness, command and control for light force insertion and platform C2. Key technologies utilized include: expert system decision support technology, database architecture development, data compression, man-machine interfacing, information filtering, advanced information display technology, digital terrain display and manipulation and automated navigation/geopositioning. Major program goals include improved force synchronization and fratricide reduction through the development and display of a common battlefield view. The battlespace command and control (BC2) advanced technology demonstration (ATD) will take technologies for common view of the battlefield from the combined arms command and control (CAC2) ATD and other sources to develop prototype software capabilities and architectures supporting the Army digital battlestaff requirements for merging situation awareness and battle command with mission planning/rehearsal and battlefield visualization capabilities. Tri-service interoperability and supporting information architecture will also be determined. Joint developer/user warfighting demonstrations will be conducted in conjunction with the Mounted, Dismounted, and Battle Command Battle Labs. Products will be transitioned to Program Executive Offices (PEOs) (Command, Control and Communications Systems (C3S), Aviation, etc.) for integration within their systems and subsequent fielding. The Rapid Force Projection Initiative (RFPI) technologies will provide command, control and communications (C3) hardware and software products that integrate RFPI hunter-standoff killer and C3 technologies and systems in a manner that supports integration with Force XXI Battlefield Operating Systems and Army Tactical Command and Control System (ATCCS) components.</p> <p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>• 15686 - Completed joint combined arms command and control (CAC2) demonstration in conjunction with the Mounted Battlespace Battle Lab and demonstrated components of a brigade digital force.</li> <li>• 1750 - Began battlespace management effort to extend the CAC2 system architecture to joint/multi-national forces and extend the CAC2 database architecture to the complete data element set.</li> <li>- Continued development and evaluation of RFPI C2 architecture and software.</li> <li>- Performed RFPI digital integrated laboratory (DIL) testing to verify system performance.</li> <li>- Designed prototype RFPI light tactical operations center (TOC) and fabricated three systems.</li> </ul> <p>Total 17436</p>											

Project D101

Page 2 of 8 Pages

Exhibit R-2 (PE 0603772A)

456

Item 43

UNCLASSIFIED

# UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE	February 1997
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT	
3 - Advanced Technology Development	0603772A Advanced Tactical Computer Science and Sensor Technology	D101	
FY 1997 Planned Program:			
•	9369	- BC2 ATD: Develop battlefield visualization prototype to provide software tools supporting: consistent battlespace understanding; forecasting, planning, and resource allocation; integrated force management.	
		- Demonstrate initial commander and battle staff work station at Task Force XXI advanced warfighting experiment (AWE).	
		- Evaluate the requirements for division, brigade and battalion command, control, computers and intelligence (C4I) architecture which is interoperable with corps, joint and allied assets.	
•	3752	- Complete prototype RFPI light digital TOC (LDTOC) and LDTOC simulator integration and fabrication.	
		- Perform RFPI LDTOC DIL inter-operability testing.	
		- Develop RFPI LDTOC distributed command and control (DC2) and communication software.	
		- Integrate hardware and software for LDTOC and LDTOC simulator.	
		- Deliver hardware for RFPI Advanced Concept Technology Demonstration (ACTD) (LDTOC and LDTOC simulator).	
•	309	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.	
Total	13430		
FY 1998 Planned Program:			
•	10630	- BC2 ATD: Demonstrate a composite digital terrain/enemy/friendly visualization display with embedded, linked combat information and conduct collaborative planning across the battlespace. This includes integrated situation awareness, collaborative replanning and rehearsal and decision support.	
		- Conduct analysis of tactical Internet and wideband communications systems performance to permit improvements in C4I warfighting capability encompassing transmission of data, imagery, and tactical video teleconferencing.	
		- Evaluate the battlefield visualization (BV)/C2 prototype capabilities through participation in AWE/battle lab warfighting experiment (BLWE) as well as participation/integration in experiments and demonstrations with the rapid battlefield visualization (RBV) ACTD.	
•	2115	- Complete light digital TOC (LDTOC) communications processor.	
		- Complete LDTOC C2 software.	
		- Perform LDTOC modifications.	
		- Support modeling and simulation analysis for the advanced concepts to be employed during the RFPI ACTD.	
Total	12745		
Project D101		Page 3 of 8 Pages	
		Exhibit R-2 (PE 0603772A)	

Project D101

Page 3 of 8 Pages

Exhibit R-2 (PE 0603772A)

457

Item 43

UNCLASSIFIED

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603772A Advanced Tactical Computer Science  
and Sensor Technology

D101

## FY 1999 Planned Program:

- 12973 - BC2 ATD: Demonstrate prototype C2 decision aids using advanced concepts in tactical assessment and forecasting. Also include interactive modeling and simulation (wargaming) and course of action analysis supporting mission planning/rehearsal/execution.
- Systems architecture efforts will focus on multi-echelon Joint/Allied assets providing faster/more accurate/more intuitive/tailored information.
- Transition validated technology solutions/capabilities to applicable PEOs.
- 4344 - Provide the capability to accomplish commander's command and control mission/functions while on-the-move.
- Assess the ability of computer-aided decision support for the reduction of staff workload.
- Provide a test bed for the command, staff and developer communities to integrate diverse concepts into C2 platforms.
- Provide a live to virtual capability to support C2 experimentation in AWEs/BL WEs..

Total 17317

## B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
17871	13988	12775	17375
18686	13430		
-1250			
17436	13430	12745	17317

Project D101

Page 4 of 8 Pages

Exhibit R-2 (PE 0603772A)

458

Item 43

UNCLASSIFIED

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE February 1997	
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603772A Advanced Tactical Computer Science and Sensor Technology								D243	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D243	Sensors and Signal Processing	3125	955	3863	5762	6686	6155	6724	7012	Continuing	Continuing
<p><b>A. Mission Description and Justification:</b> This project provides for advanced development of new radar and signal processing concepts for bistatic radar, low cost tactical aerial vehicle radars, and ultra-wideband foliage penetrating radar. The bistatic radar for weapons location (BRWL) technology demonstration provides advanced transmitter and signal processing technology for improved real-time, all-weather, automatic detection, classification and identification of artillery, mortar, cruise missile and aircraft targets, while significantly enhancing survivability of the radar system. The low cost airborne moving target indicator (MTI) radar will provide wide area surveillance capability in a modular package adaptable to multiple tactical aerial vehicle applications, including unmanned aerial vehicle (UAV) platforms. A new generation of ultra-wideband radars will provide foliage and ground penetrating technology for aerial surveillance and targeting, and enhance minefield and bunker detection capabilities.</p>											
<p><b>FY 1996 Accomplishments:</b></p> <ul style="list-style-type: none"> <li>3125 - Completed demonstrations of BRWL in advanced warfighting experiments with Depth and Simultaneous Attack Battle Laboratory and provided technology option to the Firefinder pre-planned product improvement (P3I).</li> </ul> <p>Total 3125</p>											
<p><b>FY 1997 Planned Program:</b></p> <ul style="list-style-type: none"> <li>939 - Evaluate moving target indicator (MTI) and synthetic aperture radar (SAR) technologies and complete payload preliminary design trade-offs for compact tactical aerial vehicle applications.</li> <li>16 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.</li> </ul> <p>Total 955</p>											
<p><b>FY 1998 Planned Program:</b></p> <ul style="list-style-type: none"> <li>3863 - Complete evaluation and component/module testing of affordable MTI/SAR radar technologies, and initiate design and development of radar technology demonstrator for application to future tactical UAVs.</li> </ul> <p>Total 3863</p>											
<p><b>FY 1999 Planned Program:</b></p> <ul style="list-style-type: none"> <li>5762 - Complete fabrication and module testing of compact, affordable radar assembly and initiate integration onto aircraft for test and demonstration.</li> <li>- Initiate design of advanced waveform and transmitter modules for ultra wide band radar for foliage and ground penetration.</li> </ul> <p>Total 5762</p>											
Project D243											

Exhibit R-2 (PE 0603772A)

Page 5 of 8 Pages

459

Item 43

UNCLASSIFIED



UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

3 - Advanced Technology Development

0603772A Advanced Tactical Computer Science  
and Sensor Technology

D243

B. Project Change Summary

FY 1997 President's Budget

Appropriated Value

Adjustments to Appropriated Value

FY 1998 Pres Bud Request

FY 1996

3200

3290

-165

3125

FY 1997

975

955

FY 1998

3862

FY 1999

5768

3863

5762

Project D243

Page 6 of 8 Pages

Exhibit R-2 (PE 0603772A)

460

Item 43

UNCLASSIFIED

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATE	February 1997
BUDGET ACTIVITY		PE NUMBER AND TITLE								PROJECT	
3 - Advanced Technology Development		0603772A Advanced Tactical Computer Science and Sensor Technology								D281	
COST (In Thousands)		FY 1996 Actual	FY 1997 Estimate	FY 1998 Estimate	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	Cost to Complete	Total Cost
D281	Ground Combat Identification Demonstrations	6624	6897	3362	0	0	0	0	0	0	25865

**A. Mission Description and Justification:** The objective of this project is to select, develop, and demonstrate techniques that minimize fratricide and increase combat effectiveness during ground-to-ground and air-to-ground engagements, and to demonstrate integration of advanced target identification (ID) and situational awareness (SA) capabilities into the digitized, Joint battlefield environment and architecture. Selection of candidate approaches for technical and operational field evaluation are made based on results of architecture investigations for the combined arms battlefield. This advanced development serves as the foundation for the Joint advanced concept technology demonstration (ACTD) for air-to-ground and ground-to-ground combat ID. The ACTD will utilize the Army's Task Force XXI digitized brigade advanced warfighting experiment (AWE) and all services combat identification evaluation team (ASCIET) field experiments as a means to assess operational utility of these new capabilities. Information derived from these field experiments will support specification of follow-on engineering and manufacturing development (EMD) efforts.

**FY 1996 Accomplishments:**

- 3000 - Completed tradeoff experiments and analyses for technology options to improve the target ID capability for battlefield combat identification system (BCIS)
- 3624 - Completed experimental analysis of digital data link performance for prototype enhancements to BCIS and completed software design modifications and integration in preparation for Task Force XXI AWE.
- 3624 - Completed technical field experiments with prototype air-to-ground combat identification (CI) system alternatives, selected and completed development of technologies to be demonstrated in Task Force XXI AWE and ASCIET exercises, and initiated training of operational personnel.
- - Conducted virtual simulation of BCIS digital data link and air-to-ground CI systems alternatives.

Total 6624

**FY 1997 Planned Program:**

- 6738 - Conduct Joint combat identification ACTD. Complete user training on enhanced BCIS and air-to-ground CI equipment, support Task Force XXI AWE and ASCIET field exercises, and assist in data analysis.
- 159 - Integrate advanced CI hardware/software with advanced target acquisition (2nd GEN FLIR) and battlefield digitization equipment (digital applique) from the Army horizontal technology integration (HTI) and science and technology base programs, and perform initial technical experiments.
- - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 6897

Project D281

Page 7 of 8 Pages

Exhibit R-2 (PE 0603772A)

Item 43

UNCLASSIFIED

## RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE

February 1997

BUDGET ACTIVITY

PE NUMBER AND TITLE

PROJECT

## 3 - Advanced Technology Development

0603772A Advanced Tactical Computer Science

D281

## and Sensor Technology

## FY 1998 Planned Program:

- 3362 - Extend FY 1997 situational awareness (SA) through sight field demonstration to include Enhanced Battlefield Combat Identification System (E-BCIS), appliqué and other acquisition and target ID systems.
- Complete analysis of extended positional accuracy capabilities of system based E-BCIS and other systems.

Total 3362

## FY 1999 Planned Program: Program not funded in FY 99.

B. Project Change Summary

FY 1997 President's Budget  
Appropriated Value  
Adjustments to Appropriated Value  
FY 1998 Pres Bud Request

FY 1996	FY 1997	FY 1998	FY 1999
6784	7136	3412	0
6976	6897		
-352			
6624	6897	3362	0

Project D281

Page 8 of 8 Pages

Exhibit R-2 (PE 0603772A)

462

Item 43

UNCLASSIFIED

UNCLASSIFIED

APPENDIX A

RD&E CONGRESSIONAL DESCRIPTIVE SUMMARIES  
MAILING LIST

PRINT

ADDRESS

1	USD (Policy), Pentagon, Room 4B926, Washington, DC 20301-2100
1	DOD Compt, MS, DMI, Pentagon, Room 1B728, Washington, DC 20310-1100
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11	ASD(C3I), Pentagon, Room 3E209, Washington, DC 20310
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